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RESEARCH ANALYSIS CORPORATION

Study of the Prepositioning Concept Prior to BIG LIFT (U)

by
Ralph A. Hafner
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PREPARED FOR THE
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Study of the Prepositioning Concept Prior to BIG LIFT (U). (8)

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FOREWORD

The principal function of the Research Analysis Corporation Field Office, Europe (RACFOE) is to conduct studies of problems considered by the Commanding General, Seventh Army, to be most pertinent to increasing combat readiness of the command.

This report was prepared as a part of RACFOE Research Project 3, "Review and Evaluation of the Concept and Procedures Pertaining to Prepositioned Equipment in Seventh Army (U)." The objective ~~of this project~~ is to study current organizational structure, procedures, and practices necessary to maintain equipment in a combat-ready posture, with a view to possible improvement within the resources of United States Army, Europe.

This report is concerned with prepositioning prior to Operation BIG LIFT and is based on the information then available. The procedural changes made in preparation for BIG LIFT made it advisable to partition the study so that the salient features of the two phases could be treated separately. Accordingly this report deals with the situation up to BIG LIFT and is therefore largely historical. One of its chief values is considered to be pointing up problems to be guarded against in future prepositioning. Performance during BIG LIFT has been reported separately in an interim report (February 1964), and all findings will be summarized in a final report. The results from the evaluation of BIG LIFT confirm the conclusions and recommendations of this report.

Joseph A. Bruner
Director, RAC Field Office, Europe
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ABSTRACT

Complete equipment for 2 divisions (ROCID and ROCAD) and 10 combat-support units was prepositioned at 11 locations in or west of the Rhine valley in late 1961. It was maintained by elements of the two CONUS-based divisions until the fall of 1962, when custody was transferred to three TD maintenance groups. A small portion of the equipment got into operation during Long Thrust exercises; most of the reliability evaluation had to be based on these operations.

Steps have been taken slowly by Seventh Army to correct certain obvious deficiencies in the storage system, but others remain unresolved. The vulnerability of the sites to attack, particularly during "marry-up" of the division with its equipment, is a problem that may be solved only by early warning and the development of standing operating procedures for dispersal in small staging areas. A major revision of the custodial organization is necessary, tailored in the proper strength and skills to meet the imposed workload—defined as the minimum amount of maintenance per maintenance cycle required to obtain a state of readiness and reliability near that of the theater average (revised as of 1 Apr 64). The use of a Civilian Labor Group to replace the military group is recommended for further study.

The lack of repair parts was a major deficiency most probably caused by non-requisitioning. Two-thirds of the discovered deficiencies remained uncorrected for long periods. (This condition has been alleviated since BIG LIFT.) Without major replacement assemblies, at least one-third of the vehicles can be expected to become inoperative in 90 days.

It is considered good management to fund and operate prepositioning as a special project.

SUMMARY

Problem

To evaluate the effectiveness of organization structure, procedures, and practices established to maintain prepositioned equipment in a combat-ready posture and to make recommendations for possible improvement within the resources available to US Army, Europe (USAREUR).

Facts

The prepositioning of equipment, originated in 1961 by Commander in Chief, Europe (USCINCEUR) and Joint Chiefs of Staff (JCS), was conceived as a method for rapidly augmenting the force structure of the Seventh Army with a minimum demand on transportation resources. The allowable period for deployment of these additional forces from alert to designated combat location in the theater was to be "no more than 14 days after the start of a war."[1] (However, that the airlift will take place only during a "period of tension" prior to hostilities is more than a possibility.)

The decision was made in October 1961 that the entire tables of equipment (TE) for the 2d Armd Div and the 4th Inf Div, plus 10 combat-support units, were to be prepositioned in accordance with the concept.[1] In early 1963 it was decided that individual equipment (weapons, gas masks, clothing, etc.) would not be prepositioned but would be carried into the theater by the individual.[2]

Initially the custody and maintenance of this equipment was the responsibility of Liaison and Maintenance (L&M) detachments from the divisions concerned. In the summer of 1962 this mission was transferred to three table of distribution (TD) maintenance groups, which still had custody as of Mar 1964. The groups were manned by levy on Seventh Army active units. Maintenance procedures were prescribed by Seventh Army.[3]

Equipment was stored in military installations in Mannheim, Karlsruhe, Kaiserslautern, Germersheim, and Pirmasens in Germany, and at Chenevières in France, with some minor repositioning of prepositioned equipment prior to July 1963. Equipment for prepositioning came from various sources in the theater and from continental United States (CONUS) and contained quantities of Standard B vehicles and vehicles approaching technical-obsolescence action.[1]

Several staff studies were made of the implementation of the prepositioning concept by Seventh Army, Seventh Army Support Command, and Packaging and Preservation (P&P) teams from CONUS prior to, or concurrently with, the

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inception of this study in February 1963.[1] The staff study prepared under the direction of the G4 section of the Seventh Army Support Command in March 1963 revealed that (a) the equipment had been received in a very poor state of repair, (b) critical tool shortages existed, (c) facilities were for the most part entirely inadequate, (d) most of the personnel were low in morale and in level of skill, and (e) the maintenance procedure was viewed with a great deal of skepticism.[4]

A portion of the equipment of the Infantry Maintenance Group (IMG) was put into operation for 6-month periods by LONG THRUST (LT) exercises, (airlift from CONUS to Europe) rotating every 3 months, so that there were always two LT battle groups in the theater equipped with prepositioned materiel. Before temporary discontinuance of LT exercises in mid-1963, some 1100 wheeled vehicles had been operated. In the Armored Maintenance Group (AMG), 275 vehicles were taken for 100-mile road marches in small march units over a period of about 6 months.

Discussion

Prepositioning Concept

The principle of prepositioning equipment for future use is not new. The concept itself needs no defense, but prepositioning on such a large scale, particularly when the equipment is to be always ready for instant use, creates many logistical problems beyond the experience of the Army as a whole. The implementation of this concept has been a history of trial and error, with changes in procedures following one another with comparative rapidity, and, prior to BIG LIFT, apparently without precise knowledge of the efficacy of previous changes.

The logistic system in Europe is geared to the support of those units now in the theater. The introduction of two additional divisions at the outbreak of hostilities, or even during a period of tension, will unquestionably strain this system until the remainder of the division slices arrive and normal support is established; this period is estimated by AR 220-10[5] to be about 90 days. During this period the two divisions would be required to be more or less self-sustaining, even though it is probable that the slice manpower could be deployed in 30 days. Prepositioning an adequate amount of support materiel, the type and quantities to be determined by study, would be necessary to allow the rapid response envisioned in the concept. Airlift of at least the forward support elements would do much to ensure the early and continuing availability of the two divisions for combat. It is considered that implementation would have the least deleterious effect on the combat posture of the Seventh Army if prepositioning were funded and operated as a special project, separate from Seventh Army but monitored by it.

Corrective Steps in Process

Most of the findings of the G4 staff study[4] have been corroborated by the RAC Field Office, Europe (RACFOE) study team. The Seventh Army is taking steps to correct some of the deficiencies in facilities and is considering reorganization of the maintenance groups [the Augmentation Readiness Group (ARG) was activated 1 Apr 64 in place of the three original maintenance groups] and the issuance of tools under a table of allowances (TA). A system of fogging (introduction of a preservative into the engine), proposed by an Army P&P team, has been introduced and plans are under way for the construction of storage warehouses with controlled humidity. Facilities have been improved since they were first inspected by RACFOE personnel. Not much has been done with respect to hardstand and drainage, but shop space has increased, and future cold-weather periods should not have so drastic an impact on maintenance activities as the winter of 1962–1963 had. Some improvements have been funded, and with time and a continuous effort the situation should become better.

Because of the corrections being introduced in these areas this study emphasizes the status of equipment* and the interim size and composition of the custodial force.* When and if controlled humidity is introduced, the custodial force will again change composition as a matter of course.

Site Vulnerability

It can be considered certain that each site has been acquired as a target, and, if hostilities were to commence without warning, the materiel could be rendered ineffective either before arrival of the using unit (either CONUS-based units, hastily mobilized allied units, or reinforced existing units) or at the time of "marry-up" at the staging areas when these targets become more lucrative. If there is a mobilization period or period of tension (an assumption vital to the success of Operation BIG LIFT—deployment of the 2d Armd Div in a super LT-type exercise) and marry-up is not interdicted, the vulnerability of the site would not be a problem. If political overtones are neglected, the G2 continuing "Estimate of the Situation" may well be the only instrument by which the proper time for dispersal or other preventive action can be ascertained early enough to be effective.

Organization

A major revision of the TDs is indicated. The current TDs are operational in character and include Military Occupational Specialties (MOSs) that bear little

*According to Seventh Army Ordnance Officer comment, DA has approved upgrading of prepositioned equipment as follows: M35 for M34 2½-ton trucks, M113 for M59 armored personnel carrier (APC); M60 for M48 tanks; M151 for M38 ¼-ton trucks.

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relation to the custodial mission.* The maintenance groups have been faced with the problem of training personnel as warehousemen, drivers, clerks, and mechanics. Provisional detachments were set up in AMG, but, before sufficient data were procured on the reorganization, preparations for BIG LIFT were started. However, the provisional detachments were formed within the existing structure and consisted only of a rearrangement of the existing manpower. A survey and analysis of the routine workload is required in order to arrive at an accurate manning of the unit to include proper MOSs and strength. The TD does not have a companion TA, and the prepositioned tools are now used.

Existing Data

The lack of records on equipment other than automotive led to the decision to study only automotive equipment, under the hypothesis that combat effectiveness, in terms of readiness and reliability, could be estimated from a study of the mobility of the divisions. The questioned accuracy of second-echelon repair records hampered the study of sustained availability (reliability) somewhat prior to BIG LIFT, but presumably complete and accurate records of third-echelon repair were available. To obtain a standard for comparison the records of three active battle groups were also studied and a "typical" performance record established.

Utilization of Manpower

Because of misalignments in the TDs and the workload demand generated by the procedures prescribed in the Seventh Army Letter of Instructions (LOI)[3] governing maintenance, RACFOE estimated on the basis of available records that the MOS utilization of personnel was low during the first year of operation under the TDs.† By way of comparison, investigation of a civilian labor group (CLG) utilizing German nationals showed a much better manpower utilization at less cost and with only a modest increase in gold outflow. The nature of the military organization is generally such that a typical unit in peacetime has a planned utilization of manpower potential of about 80 percent which in war becomes closer to 60 percent, not considering the additional workload generated by enemy action. Tables have been compiled in the text to estimate manning requirements of the maintenance groups for various levels of maintenance effort as a function of Utilization of Potential Indexes (UPI). Records of IMG show that organizational maintenance effort in preparation for an LT exercise

*Based on a detailed survey made by the maintenance groups, a new TD was developed and has been implemented as a single agency, the ARG, on 1 Apr 64. The MOS structure is such that few training problems should arise. (ARG comment.)

†Approximately 40 percent in IMG because of the additional workload generated by LT exercises but lower in AMG and combat support maintenance group (CSMG). With the increased workload under the new maintenance program manpower utilization should approach the 60 to 80 percent norm.

has been at the level of 8 to 9 man-hours per wheeled vehicle (calculated MOS time available for these Q inspections: 17 to 20 man-hours per vehicle, including its trailer). IGM considers their records to be grossly inaccurate and that the actual man-hours were between 16 and 24 hr per wheeled vehicle. No data exist relative to vehicle performance at a higher level of effort proposed by the maintenance groups (49 man-hours on wheeled vehicles including the preservation process—77 man-hours on tracked vehicles every 6 months). Preparation for BIG LIFT will presumably require a high level. AMG and Ordnance maintenance records of BIG LIFT acquired later indicated a high level of organizational maintenance at about 60 man-hours per vehicle.

Skill Levels

No evidence was acquired during this study concerning the contention[1] that enlisted personnel have a level of skill generally below that specified in the TD. In any event it is expected that rotation will eventually result in a level of skill commensurate with the average theater level, and this problem will resolve itself in time. According to a Seventh Army Ordnance officer a study is under way to bring the authorized skills in line with the requirements.

Efficiency of the Maintenance Program

The necessity for maintenance preparatory to extended operation as in LT exercises demonstrates the inefficacy of the exercise program (biweekly movement, one space forward and return) prescribed by LOI [3] to maintain the equipment in a state of operational readiness. Note that the recommendation of the P&P team for preservation by fogging eliminates the exercise procedure. At the time BIG LIFT was approved the equipment in the AMG was considered to be in such poor shape that considerable ordnance and organizational support was required for the period 8 July 1963 to D-Day, 22 October. The augmentation to the AMG was reported by V Corps and AMG to be approximately 700 mechanics and drivers. The 57th Ord Gp reported 619,000 man-hours spent in preparation of the vehicles for issue to the division, including requisitioning, application of modification work orders (MWOs), and necessary inspection and repair.

Lack of Repair Parts

One of the major problems in the maintenance groups has been the perennial lack of repair parts. Although there have been some parts shortages, possibly a little greater than those experienced by active units, the chief reason why there were parts shortages prior to BIG LIFT, according to ARG, was that the parts had not been properly requisitioned. In a spot check of 690 uncorrected deficiencies, about two-thirds had been delayed for indefinite periods owing to the unavailability of parts. The number and type of major components and repair parts available for preissue maintenance will govern the length of time the vehicles can remain in operation and the availability for

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immediate issue. It is also possible that a revision of the Authorized Stockage List/Authorized Organizational Stockage List (ASL/AOSL) may be necessary for prepositioned vehicles. Information from BIG LIFT will be pertinent to this aspect.

Vehicle Performance

In the matter of major assembly replacements, even with the low level of preparatory maintenance prior to an LT exercise, the prepositioned equipment performed in a manner comparable to that of other active units in the theater. In the first 90 days of operation, based on a usage rate of 500 miles/month for wheeled vehicles, 25 to 30 percent of the vehicles will have had their first major assembly replacement.

The magnitude of the preparatory maintenance effort has a very important effect on the sustained reliability of the equipment. For example, when about 700 vehicles from the AMG were road marched for 100 miles directly off the park without any preparation the potential damage to the vehicles was expected to be so great that the procedure was discontinued after 10 days. These marches included fair-sized samples of each type of vehicle stored. Of the 145 tracked vehicles marched 25 miles, 20 fell out and 13 were towed back to the park. Of the 542 wheeled vehicles, 81 fell out and 29 had to be towed. For tracked vehicles the power train (overheating) accounted for over half the deficiencies. For wheeled vehicles, wheel cylinders and brakes caused the majority of failures. On 25 July, the last day of the march, the deadline report showed that 148 vehicles participating in the march were on third-echelon deadline. With no preparatory maintenance approximately 21 percent of the vehicles developed major deficiencies within 100 miles.

A new high-level maintenance procedure was then introduced: semiannual inspection and repair followed by a road test, and a technical inspection and repair. This was intended to put the vehicles in ready condition that could be checked by performance during BIG LIFT. The operational readiness of the vehicles issued was actually higher than 98 percent, and the vehicles performed quite satisfactorily on the whole during BIG LIFT.

There is some indication developed from preparation for LT VIII and several road tests in AMG that while in storage for a period of no more than 6 months, about 6 to 9 percent of the vehicles developed major deficiencies through nonoperation. This finding is not considered conclusive because of the possibility of incomplete quarterly (Q) inspections in preparation for storage.

After 6 months' operation, during which normal maintenance procedures were followed, 22 percent of the returned LT vehicles required third-echelon work prior to restorage. The cause of this condition could not be ascertained since it could be ascribed to a number of different reasons.

Controlled Test

On LT exercises this study shows that prepositioned equipment performed quite well in comparison with average theater equipment, but there is reason

to believe that the vehicles studied were not selected at random but were in better repair than the bulk of the prepositioned stock. A sampling procedure consisting of marching 100 randomly selected vehicles 200 miles was arranged but was discarded in favor of data obtainable on BIG LIFT. From the data in hand it was possible to estimate operational readiness, i.e., the probability of starting a vehicle and driving it to a predesignated starting point, and this was estimated to be about 91 to 94 percent. However, the estimation of reliability (or availability) of the fleet in day-to-day operation over a period of time was beset by too many extraneous factors to permit a firm conclusion. A fairly extensive controlled test would have been recommended in any event. The necessity for this recommendation was obviated by the advent of BIG LIFT.

Conclusions

Validity of Concept

1. The prepositioning concept is valid, but the implementation of this concept to obtain rapid effectiveness for two divisions may require an allocation of theater resources in such quantity as to affect the combat effectiveness of forces in being.

Operation BIG LIFT confirmed this conclusion. However, the equipment condition is constantly improving since BIG LIFT, and consideration is being given to extending the staging time. This conclusion is therefore only applicable to the situation prior to BIG LIFT.

Vulnerability

2. A timely intelligence estimate is necessary before the outbreak of hostilities to give sufficient warning of enemy intention to take preventive measures to protect the prepositioned materiel from enemy action.

The prepositioned equipment presents such a lucrative target that it is possible the entire validity of the prepositioned concept may turn on the availability of early warning.

3. Operational plans do not generally include alternative dispersal areas and plans for movement to these areas on receipt of suitable warning.

This is a matter for further study.

Division Slice and Materiel

4. Airlift of the remainder of the manpower included in selected elements of the division slice and marry-up with equipment and supply stockage in the same manner as planned for the line units would assure early and sustained equipment availability. The early airlifted increments should be heavily weighted in favor of drivers and maintenance personnel.

SUMMARY

5. A study of the type and quantity of prepositioned stock required for the division slice is required.

This study should include an estimate of the magnitude of the tax on existing support acceptable for the period of buildup.

6. To obtain a higher reliability in operation for the 90-day criterion outlined in AR 220-10[5], a sufficient number of repair parts and major component assemblies should also be prepositioned to avoid an excess drain on theater reserves.

Organization

7. The current TDs are of a combat-operational rather than a specifically functional type and are misaligned with the task assigned to them. A detailed examination of the workload to determine type and number of the MOS requirements is indicated.

This has been implemented with the reorganization of 1 April 1964.

8. The quantity and type of prepositioned equipment is subject to considerable change over time. A custodial unit formed under a flexible TD, as at present, is probably better suited to these conditions than a table of organization and equipment (TOE).

9. When the using unit acquires its equipment the custodial mission is terminated and will cease to exist in war. A detailed plan should be prepared and maintained current for the disposition of the custodial force after the issue mission is accomplished.

This has been implemented.

10. Utilization of a CLG for the custodial mission promises an acceptable state of readiness at the same time releasing military spaces.

Considering the additional military support required to put the equipment in this state under present conditions, there is reason to believe that use of CLGs would result in substantially less cost with only a small increase in gold outflow. Civilians would have to be phased in over time and personnel ceilings established through further studies of the operation at periodic intervals. Further study is indicated.

11. The alleged lower skill level of the original assigned personnel[4] will disappear through rotation, and the maintenance units will eventually achieve the average theater level of skill.

This conclusion has been confirmed. All assigned personnel were required to have rotation dates more than 1 year away. In September 1963 rotation was started and as of the date of this publication the ARG claims a level of skill comparable to theater average.

Facilities

12. The inadequancies of facilities to warehouse and maintain the prepositioned equipment have been identified by Seventh Army, and steps are slowly being taken to correct the situation.

Tools

13. The existing TD units do not now have maintenance and warehousing equipment under a TA and must resort to the expedient of using prepositioned equipment for this purpose.

Performance of Prepositioned Materiel

14. Prepositioned materiel must perform in a manner comparable to that of present active units in the theater.

This implies a state of operational readiness and prepositioned stockage in sufficient quantity to ensure a comparable reliability in operation over the period required for the establishment of normal support (see App E).

15. The cyclic exercise of vehicles was not sufficient to maintain the vehicles ready for issue.

Confirmed by BIG LIFT. Exercise has been discontinued and a new maintenance program introduced 22 July 1963.

16. A relatively low level of preparatory maintenance seems to be sufficient for the vehicles to perform at the typical theater level.

This was so on LT, but this result may have been obtained by a nonrandom selection of vehicles.

17. As the equipment ages, the level of essential maintenance effort promises to increase.

DA has approved updating the vehicles by replacement.

18. The establishment of the proper maintenance level required to maintain the vehicles ready for issue (RFI) is necessary for the determination of the appropriate manning level of the custodial unit and the required field maintenance support.

Further Test

19. The character of the data available was such that inherent biases were suspected, and completely reliable data simply did not exist.

A controlled test of some magnitude would be necessary to obtain data on materiel performance. This test would include not only an evaluation of performance of the prepositioned materiel but also the establishment of a typical theater level for comparison. BIG LIFT provided this test.

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Study of the Prepositioning Concept

Prior to BIG LIFT

ABBREVIATIONS

adm	administration (company)
AMG	Armored Maintenance Group
APC	armored personnel carrier
ARG	Augmentation Readiness Group
arty	artillery (battalion)
ASL/AOSL	Authorized Stockage List/ Authorized Organizational Stockage List
avn	aviation (company)
BG	battle group
BHQ	brigade headquarters
cav	cavalry (squadron)
CG	commanding general
CH	controlled humidity
CINCUSAREUR	Commander in Chief, US Army, Europe
CLG	civilian labor group
CONUS	continental United States
CSMG	combat support maintenance group
DA	Department of the Army
DAS	direct automotive support
div	division
DS	direct support
dvr	drivers
DX	direct exchange
engr	engineer (battalion)
FEBA	forward edge of battle area
FTX	field training exercise
GAS	general automotive support
GS	general support
HHC	headquarters and headquarters company
HSup	Headquarters, Support Command
IMG	Infantry Maintenance Group
IROAN	inspect and repair only as needed
JCS	Joint Chiefs of Staff
L&M	liaison and maintenance
LOI	letter of instructions
LT	LONG THRUST
LWR	local wage rate
mech	mechanized (battalion)
mechs	mechanics
med	medical (battalion)
MCA	military construction, Army
MI	military intelligence (detachment)
maint	maintenance
MOS	military occupational specialty
MP	military police
MWO	modification work order
OH	overhead
O&MA	Operation and Maintenance, Army (funds)
ord	ordnance (battalion)
OVM	on-vehicle materiel
POM	preparation for overseas movement (units)
P&P	packaging and preservation
Q	quarterly (maintenance inspection)
QM	quartermaster (battalion)
RACFOE	Research Analysis Corporation Field Office, Europe
RFI	ready for issue
ROAD	Reorganization Objective Army Divisions
S	semiannual (maintenance inspection)
sig	signal (battalion)
SOP	standing operating procedures
SP	self-propelled
S&T	supply and transport (battalion)
TA	table of allowances
TD	table of distribution
TE	tables of equipment
TI	technical inspection
tk	tank (battalion)
TOE	table(s) of organization and equipment
trans	transportation (battalion)
tns	trains
TS	Technical Service
twd	towed
UPI	utilization of potential index
USAREUR	United States Army, Europe
USCINCEUR	United States Commander in Chief, Europe
WVE	wheeled-vehicle equivalents

INTRODUCTION AND BACKGROUND

ORIGIN OF THE CONCEPT

The concept of prepositioning all organizational equipment of several divisions was originated in early October 1961 by USCINCEUR in conjunction with the JCS.[1] The primary feature of this concept was rapid response—defined as the capability of moving large unequipped troop units from CONUS to Europe on short notice; after picking up their equipment on arrival at destination, the units would be ready for employment on a combat mission within a maximum period of 14 days after war had started. The promise of a considerably lesser demand for transport aircraft to transport the unit equipment in a crucial situation made the concept appear very attractive and of substantial military value.

The upper limit of 14 days between the USCINCEUR movement request and deployment was established on the hypothesis that a time requirement greater than 14 days could be met equally well by sea transport.

Accordingly on 12 Oct 61 USAREUR was directed to preposition equipment for the 4th Inf and 2d Armd Divs. By the end of November L&M detachments from 10 combat and combat-support units closed in home stations in USAREUR.

INITIAL IMPLEMENTATION

Site Selection and Facilities

The correspondence between DA and USAREUR led to a survey of available sites, and a decision was made jointly to preposition equipment for the 4th Inf Div at Spinelli Barracks in Mannheim and at Neureut Kaserne in Karlsruhe with "first priority"[1] for acquisition of necessary TOE equipment for prepositioning. CINCUSAREUR directed that equipment for the 2d Armd Div and for 10 combat and combat-support units be dispersed and located far enough west of the Rhine for reasonable assurance that it "would not be overrun during the first 14 days of a war."[1] Locations selected were installations in the vicinity of Kaiserslautern (Daenner Kaserne, Kleber Kaserne, Pulaski-Kapaun Kaserne, Rhine Ordnance Barracks, and later, Ramstein Cold Storage Area), Pirmasens (D'Isley Kaserne), Germersheim (Ordnance Depot), Karlsruhe (Gerzewski Barracks), and Chenevières Air Base near Lunéville in France. The last was abandoned as of the end of October 1963, and sites at Idar-Oberstein and Lorschwald have been opened.

Facilities at most of the locations consisted of hastily prepared parking areas and buildings in various degrees of disrepair. Areas were not always adequately drained, wash racks were rare, and shops had to be improvised in many cases. The tools used had to come from prepositioned equipment and were not always adequate. Quarters for troops ranged from poor to good, and most were overcrowded. The effect of all this was compounded by the fact that none of the subordinate units was self-supporting; all were "satellited" on other contiguous organizations for many administrative details.

Manning and Organization

In November 1961 L&M detachments from the 4th Inf and 2d Armd Divs and the 10 combat and combat-support units arrived in the theater and were posted to the various locations. They were composed principally of organizational maintenance personnel who, because of a materiel-reception mission, apparently had limited opportunity to work in their primary MOS. A maximum of 3000 men was designated by DA to be dispersed at the selected locations and satellited on host units for billeting, messing, and security.[1]

Early in 1962 it was determined that the manning and organization of the caretaker units had to be changed; TD maintenance groups were organized, assigned the custodial mission,[6] and attached to Seventh Army Support Command.[7] In August 1962 the TD units took over the work on a permanent basis. By September 1962 the TD units had relieved the L&M detachments; they have continued in operation up to the date of this report.[4,8-10]

The TD units were manned by levy on Seventh Army and had a total strength of slightly under 2000. Details of the manning and organization of these units as of June 1963 are given in Table 1.

Stockage and Condition of Materiel[1] (see App A, Sec Logistics)

In October 1961 USAREUR was directed to furnish all TOE for the 2d Armd and 4th Inf Divs, except for equipment for three battle groups supplied by the 4th Inf Div. USAREUR's plan to provide the major items depended on tapping theater reserves and using excesses of limited standard equipment generated by the modernization program. These latter consisted mainly of excess M38 and M38A1 ¼-ton trucks, M59 APCs, and M48A1 tanks, apparently not in first-class condition. Theater resources were insufficient to provide aircraft and tank-recovery vehicles for the two-division force, and plans were made for reallocation of these items from active units on an on-call basis. Equipment was distributed approximately as shown in Tables 2, 3, and 4.

Only 50 automotive-mechanic tool sets were available in the theater, with 1400 required, and it was not until late December that enough arrived from CONUS for the L&M mechanics to be able to work satisfactorily in their MOS. As part of their workload, however, nearly 50,000 tons of equipment from CONUS were unloaded in the theater during November 1961 and had to be processed and distributed. In addition all the tracked equipment from Camp Darby, Italy, had to be disassembled for shipment and reassembled at destination. A major problem developed in obtaining parts for the limited standard equipment, since these had been excessed or stocks were not being replenished. Repair parts, special tools, and TOE tool sets and kits were not prepositioned in sufficient quantities to support the 38 aircraft to be issued to a division.

TABLE 1

Approximate Personnel Distribution of TD Maintenance Groups, June 1963

(Applicable only for period prior to BIG LIFT, superseded by reorganization of 1 Apr 64)

Installation	Wheeled equipment		Tracked equipment		Vehicle overhead personnel	Signal equipment		Artillery equipment		Miscellaneous maintenance personnel	Total
	Drivers	Mechanics	Drivers	Mechanics		Mechanics	Overhead personnel	Mechanics	Overhead personnel		
TD73-3782 Infantry											
Spinelli Barracks											
HHD IMC[a]	(2)									1	—
1st Inf Maint Bn Hq[a]					5.0						—
Inf Maint Co A	14	11		1	9.4	3	1.3	—	—	1	—
Inf Maint Co B	14	11		1	9.4	3	1.3	—	—	1	—
Inf Maint Co C	14	11		1	9.4	3	1.3	—	—	1	—
Armd Cav Maint Co	7	5	10	10	13.4	1	1.0	—	—	—	—
Tk Maint Co	12	6	14	19	17.5	2	1.2	2	0.4	—	—
Sig Maint Co	—	8			0.9	27	12.0				—
Trans Maint Co	20	3		30	16.6	2	0.1				—
QM Maint Co	4	3			0.8					9	—
Total	85	58	24	62	82.4	41	18.2	2	0.4	22	—
Actual on hand[b]	55	60	20	53		47					—
Neureut											
2d Inf Maint Bn Hq[a]					5.0						—
Arty Maint Btry Hq[a]											
Hq Bry Plat	1	2			1.0	3	0.2		2.3		—
How Bn 105-mm Plat		7			0.8	2	0.1	2	7.2		—
How Bn 105-mm Plat		7			0.8	2	0.1	2	7.2		—
How Bn 105-mm Plat		7			0.8	2	0.1	2	7.2		—
Ret How Bn Plat		5			0.5	1		3	6.1		—
How Bn 105-mm SP Plat		2		6	4.0	2	0.1	3	3.8		—
How Bn 105-mm SP Plat		2		6	4.0	2	0.1	3	3.8		—
Engr Maint Co	1	6	1	2	1.0	1				22	—
Ord Maint Co		18			7.5						—
Med Maint Co	2	3			0.6					6	
Trans Maint Co	3	1			7.6		1.1				—
Subtotal	7	63	1	14	33.6	15	1.8	17	37.6	28	—
Total	92	121	25	76	116.0	55	20.0	17	38.0	50	610[c]

TABLE 1 (continued)

Installation	Wheeled equipment		Tracked equipment		Vehicle overhead personnel	Signal equipment		Artillery equipment		Miscellaneous maintenance personnel	Total
	Drivers	Mechanics	Drivers	Mechanics		Mechanics	Overhead personnel	Mechanics	Overhead personnel		
TD73-3783 Armor											
Kleber											
Hq AMG[a]							5.0			1	—
Hq Co[a]	5	2			0.5						—
2d Armd Maint Bn[d]				1	7.5		1.0				—
Armd Inf Co A[d]	5	5	17	9	19.5	3	0.1				—
MP Maint Plat[d]	1	2			0.6						—
Subtotal	14	9	17	10	28.1	3	6.1			1	—
D'Isley											
1st Armd Maint Bn[a]				1	7.5		1.0				—
Armd Inf Co C	5	5	17	10	19.1	3	0.1				—
Armd Inf Co D	5	5	17	10	19.1	3	0.1				—
Engr Maint Co	11	11	1	10	2.1	2				29	—
Sig Maint Co		10		1	0.7	23	19.6				—
Subtotal	21	31	35	32	48.5	31	20.8			29	—
Germersheim											
3d Armd Maint Bn[a]				1	7.5		1.0				—
Tk Maint Co A	5	6	22	14	18.2	3	0.1	1			—
Tk Maint Co B	5	6	22	14	18.2	3	0.1	1			—
Subtotal	10	12	44	29	43.9	6	1.2	2			—
Rhine Ord Bks											
Arty Maint Bn[a]			1			3	1.1		10.0		—
Arty Maint Btry A	4	4	8	4	1.3	3	0.1	1	9.0		—
Arty Maint Btry B	4	4	8	4	1.3	3	0.1	1	9.0		—
Arty Maint Btry C	4	4	8	4	1.3	3	0.1	1	9.0		—
Arty Maint Btry R/M	5	4	8	6	1.5	2		1	11.0		—
Subtotal	17	16	33	18	5.4	11	1.4	4	48.0		—

Chenevieres											
Trans Maint Bn[a]		1	1		2.3						—
Avn Maint Co	3	4			0.5	1				11	—
Med Maint Co	3	5			0.5	2	0.1			9	—
QM Maint Co	7	7			0.9	1				12	—
Subtotal	13	17	1		4.2	4	0.1			[c]	—
Daenner											
Ord Maint Co[a, d]	6	27		1	27.0	1		6			—
Tk Maint Co C	5	6	22	14	18.2	3	0.1	1			—
Tk Maint Co D	5	6	22	14	18.2	3	0.1	1			—
Armd Cav Maint Co	11	7	20	10	16.1	3	0.1	1			—
Subtotal	27	46	64	39	79.5	10	0.3	9			—
Pulaski-Kapaun											
Armd Inf Co B[a, d]	5	5	17	9	19.5	3	0.1				
Total	107	136	211	137	229.1	71	30.0	15	18.0	62	1046.1
TD73-3784 Combat Support											
Chenevieres											
Arty Maint Btry A[a]	7	5	6			3	1.0		13.0	1	—
Arty Maint Btry B	7	5	6			3	1.0		13.0	1	—
Arty Maint Btry C	8	7	8			3	1.0		13.0	1	—
Engr Maint Co A	3	7	1			1	1.0			22	—
Engr Maint Co B	3	7	1			1	1.0			22	
Subtotal	28	31	22			11	5.0		39.0	17	—
Gerzewski											
Tk Maint Co[a]	10	6	18	15	17	2	1.0				—
Turley											
Trans Maint Bn[a]	1	2			6						—
Trans Maint Co A	4	7			8	1					—
Trans Maint Co B	4	7			8	1					—
Trans Maint Co C	4	7			8	1					—
Cml Maint Co										15	—
Subtotal	13	23			30	3				15	—
Total	51	60	40	15	47	16	6.0		39.0	62	336

[a]Overhead distributed.

[b]Physical check of TD distribution—variations caused by actual manning.

[c]621: 11 overhead distributed to CS.

[d]These units were restationed in Daenner Kaserne about June 1963.

TABLE 2

Approximate Distribution of Powered Vehicles in Infantry Division TOE before BIG LIFT

(Inapplicable to the post-BIG LIFT period because of reorganization under ROAD and restationing)

Equipment	Unit																							
	BG	BG	BG	Tk	Sig	Cav	Tns	QM	Total	Hq Arty	105-mm SP how	105 SP	105 Twd	105 Twd	105 Twd	8" 155	Ord	Med	Engr	Div HH	MI	Avn	Adm	Total	Div (-) total
Carrier																									
Mortar, 4.2 SP						9			9																9
Personnel	2	2	2	18		23	115		162		4	4					6							14	176
Howitzer, 105-mm SP											6	6												12	12
Launcher, bridge, M48																			3					3	3
Tank																									
Lt gun	2	2	2			23			29																29
Med gun				89					89										3					3	92
Recovery vehicle, med				7		4	2		13		1	1				1	1							4	17
Tractor																									
HS, 13-ton											6	6	6	6	6									30	30
LS, Diesel, med																			14					14	14
Total tracked	4	4	4	114		59	117		302		17	17	6	6	6	1	7		20					80	382
Truck																									
Amb ¼-ton	14	14	14	6		4			52		1	1	1	1	1				1	2				8	60
Util ¼-ton	58	58	58	41	18	62	23	6	324	12	25	25	25	25	25	21	18	11	28	43	10	10	5	283	607
Util ¼-ton, 106-mm	10	10	10						30																30
Amb, ¼-ton										1						1		36						38	38
Cargo, ¼-ton	51	51	51	5	84	9	3	4	258	23	13	13	17	17	17	25	23	6	10	6	2	27	2	201	459
Cargo, 2½-ton	16	16	16	18	72	13	87	11	249	14	15	15	19	19	19	17	25	7	23	2	2	17	5	199	448
Lt wkr 2½-ton	1	1	1						3													1		1	4
Shop van, 2½-ton	1	1	1		2				5	5						3	6			3				17	22
Tank, 2½-ton								30	30		1	1	1	1	1	1			1					7	37
Trctr, 2½-ton																	9		2					11	11
Cargo, 5-ton	7	7	7	19		8			48		10	10	10	10	10									50	98
Dump, 5-ton	3	3	3						9										49					49	58
Wkr med, 5-ton	1	1	1	3	1	2	1	1	11		1	1	1	1	1	3	14		1					23	34
Brdg transp, 5-ton																			9					9	9
Tractor, 5-ton								5	5										15					15	20
Trctr, wkr, 5-ton																	1							1	1
Cargo, 10-ton																8								8	8
Trctr, 10-ton																	2							2	2
Loader, scoop-type																			8					8	8
Grader																			4					4	4
Total wheeled	162	162	162	92	177	98	114	57	1024	55	66	66	74	74	74	79	98	60	151	56	14	55	12	934	1958
Total vehicles	166	166	166	206	177	157	231	57	1326	55	83	83	80	80	80	80	105	60	171	56	14	55	12	1014	2340

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TABLE 3

Approximate Distribution of Powered Vehicles in Armored Division TOE before BIG LIFT

Equipment	Distribution: D'Isley (Pirmasens)						Germersheim				Kleber (Kaiserslautern)						Doenner (Kaiserslautern)						Chenevières						Rhine Ordnance Barracks						Pulaski[b] Kapaun		Div Total	ROAD	Short	Excess
	Inf	Inf	Eng	Sig	HCC	Total	Tk	Tk	HCC	Total	Inf	Div HH	MP	Adm	MI	Total	Tk	Tk	Cav	Ord[a]	HCC	Total	QM	Avn	Med	A C M	HH	Total	105 SP	105 SP	105 SP	8" SP	Arty Hqs	Total	Inf[a]	Total				
Carrier																																								
Mortar, 4.2, SP	4	4				8	4	4		8	4					4	4	4	12			20													4	4	44	54	10	
Personnel, M59	77	77	43		6	203	17	17	6	40	77	2				79	17	17	28	9	6	77							9	9	9	8	3	38	77	77	514	504		10
Howitzer																																								
105-mm SP, M52																													18	18	18			54			54	54	—	—
155-mm and 8-in. SP, M44 M55																																16		16			16	22	6	
Launcher, bridge, M48			6			6																															6	14	8	
Tank																																								
Lt gun																																					—	41	41	
Med gun, M48A1 M60			12		2	14	72	72	2	146							72	72	32		2	178															338	270		68
Recovery vehicle, med, M88	6	6	2			14	6	6		12	6					6	6	6	6	4	2	22							2	2	2	2		8	6	6	68	64		4
Tractor, FS, diesel, med			7			7																															7	21	14	
Total tracked	87	87	70		8	252	99	99	8	206	87	2				89	99	99	78	13	8	297							29	29	29	26	3	116	87	87	1047		79	82
Truck																																								
Amb, ¼-ton, M170			3			3																															3	42	39	
Util, ¼-ton, M38A1	49	49	38	18	18	172	44	44	18	106	49	25	14	5	10	133	44	44	85	21	18	212	15	10	13	2	5	45	35	35	35	25	17	147	49	49	864	814		50
Amb, ¾-ton, M43												1				1							1		32			33									34	49	15	
Cargo, ¾-ton, M37B1	5	5	5	84	6	105	6	6	6	18	5	4	5	2	2	18	6	6	11	12	6	41	14	26	8	2	2	52	27	27	27	35	18	134	5	5	373	482	109	
Cargo, 2½-ton, M34, M35	17	17	36	72	4	146	17	17	4	38	17	6	3	7	2	35	17	17	16	71	4	125	66	17	28	2	3	116	21	21	21	26	11	100	17	17	577	659	82	
Lt wkr, 2½-ton																								1				1									1	0		1
Shop van, 2½-ton, M109				2		2						7				7				21		21		3			2	5	2	2	2	5	3	14			49	69	20	
Tank, 2½-ton, M49C	4	4	6			14	6	6		12	4					4	6	6	6			18	5	4				9	2	2	2	2		8	4	4	69	89	20	
Trctr, 2½-ton, M275																				8		8				1		1									9	10	1	
Cargo, 5-ton, M54	13	13				26	24	24		48	13					13	24	24	18			66	48					48	14	14	14	14		56	13	13	270	223		47
Dump, 5-ton			40			40																															40	35		5
Med wkr, 5-ton, M543	2	2	6	1		11	3	3		6	2					2	3	3	2	13		21	2					2	1	1	1	3		6	2	2	50	48		2
Brdg trans, 5-ton			42			42																															42	53	11	
Trctr, 5-ton, M52			9			9														2		2	18			1		19									30	47	17	
Trctr, wrecker, 5-ton, M246																										1		1									1	1	—	—
Cargo, 10-ton																																8		8			8	0		8
Trctr, 10-ton, M123																				6		6															6	16	30	
XM408, ¼-ton	4	4				8	5	5		10	4	1				5	5	5	5			15							1	1	1	1	1	5	4	4	47	0		47
Loader, scoop-type			3			3																															3	12	9	
Grader			1			1																															1	4	3	
Total wheeled	94	94	189	177	28	582	105	105	28	238	94	44	52	14	14	218	105	105	143	154	28	535	169	61	81	9	12	332	103	103	103	119	50	478	94	94	2477			
Total vehicles	181	181	259	177	36	834	204	204	36	444	181	46	52	14	14	307	204	204	221	167	36	832	169	61	81	9	12	332	132	132	132	145	53	594	181	181	3521			
Truck																																								
Util, ¼-ton, 106																																					0	24	24	
Util, ¼-ton, Davs Cr																																					0	10	10	
																																							170	160

[a] Units interchanged in June 1963.
[b] Changed to Cold Storage Area, Ramstein, June 1963.

TABLE 4

Approximate Distribution of Powered Vehicles in Combat and Combat-Support Units TOE before BIG LIFT

(Initial and 31 Jul 63; inapplicable to the post-BIG LIFT period because of reorganization under ROAD and restationing)

Equipment	Distribution													
	Turley (Mannheim)					Germersheim		Lorschwald				Gerzewski barracks (Karlsruhe)		Grand total[a]
	HH	Trans	Trans	Trans	Total	Engr	Engr	155 Twd	155 Twd	8" Twd	Total	Tk	Total	
Tracked carrier, personnel												17	17	17
Tank														
Medium gun												72	72	72
Recovery vehicle, medium								1	1		2	6	6	8
Tractor														
HS, 13-ton								18	18	6	42			42
LS, diesel, medium						7	7				14			14
Total tracked						7	7	19	19	6	58	95	95	153
Wheeled truck														
Amphibious, ¼-ton						1	1				2			2
Utility, ¼-ton	12	5	5	5	27	30	30	26	26	25	137	44	44	208
Amphibious, ¼-ton								1	1	1	3			3
Cargo, ¼-ton						22	22	32	32	32	110	6	6	146
Cargo, 2½-ton	3	61	61	61	195	15	15	25	25	23	103	17	17	315
Shop van, 2½-ton								1	1	4	6			6
Tank, 2½-ton		1	1	1	3							6	6	9
Cargo, 5-ton								18	18		36	24	24	60
Dump, 5-ton						39	39				78			78
Medium worker, 5-ton		1	1	1	3	1	1	1	1	1	5	3	3	11
Tractor, 5-ton						7	7				14			14
Cargo, 10-ton										18	18			18
XM408, ¼-ton												5	5	5
Total wheeled	15	71	71	71	228	115	115	101	101	101	542	105	105	875
Total vehicles	15	71	71	71	228	122	122	123	123	110	600	200	200	1028

[a]Prepositioned powered vehicles, all units (Tables 2, 3, and 4): wheeled, 5310; tracked, 1582; total 6892.

Third-echelon support was obtained from two general-support (GS) and one direct-support (DS) ordnance companies and a signal forward support company. The field-maintenance inspection indicated a very considerable base-maintenance workload generated by the condition of 600 APCs and 750 ¼-ton trucks, besides a substantial amount of installation and reconditioning work on signal and engineer equipment. The 4th Inf Div in LT IIA, the first test of the system, sent 95 percent of its equipment ahead from Ft Lewis, Wash., and checked out the concept successfully from the standpoint of time and airlift. LONG THRUST IIA did not leave the staging area and apparently did not check the condition of the prepositioned equipment.[1]

The L&M detachments, with third-echelon support, may have performed quarterly (Q) maintenance inspections of most of the equipment during their tenure, but few records remain to support a conclusion of this nature. Statistical records were not required, and much that would have been useful in subsequent evaluation had been disposed of or is unavailable. However, those few maintenance records that have come to light are sufficient to justify the assumption that inspections were made but few repairs attempted.

The after-action report of LT IIA emphasized the many problems that had developed during the implementation of the prepositioning concept. Corrective action is continually being taken to reduce these problems, but some are inherently uncorrectable without major expenditure of funds or effort. For example, the report points out that planning and implementation were far too hasty and that greater promise of operational readiness, reliability, and, consequently, mission accomplishment would have resulted if time and care had been taken.[1]

DEVELOPMENT OF PROCEDURES

In late January 1962 Seventh Army published a directive for the exercise of prepositioned equipment,[3] and in October 1962 the Seventh Army Support Command published a "Letter of Instructions, Operations" for guidance of the groups. In spite of subsequent changes in organization and manning, the procedures remained in effect to about May–July 1963. At that time a more extended procedure was introduced. A P&P team from CONUS visited USAREUR in February 1963 and proposed certain measures that at this writing have been adopted and are scheduled to be put into practice on vehicles returned from BIG LIFT.

The Seventh Army LOI directed that powered mobile equipment was to be started, warmed, moved at least one vehicle length forward or backward, and then returned to position. Exercise SOPs were developed by both maintenance groups for detailed exercise of specific items (see App A).[11,12] No Q inspections were to be performed until the equipment had been put into operation. All deficiencies discovered during exercise were to be reported. Corrections could be made on the spot, deferred for supply action on spare parts, or evacuated to higher echelon.

The LT concept put the equipment of two battle-group task forces into operation. On conclusion of a 6-months' exercise the vehicles of one battle group were turned in, a Q inspection was performed, corrections were made,

and the vehicles were returned to active storage. At the same time an incoming battle-group task force took on its prepositioned equipment and was deployed for 6 months. In this fashion the vehicle population at the custodial sites remained constant.

Storage

All vehicular equipment is in active storage, but many smaller items, particularly QM issue, are in dormant storage, i.e., depot pack.

Active storage[13-15] is concerned primarily with the establishment of a readiness posture at a specified level (see App D). Only those items remain packaged that can be put to use immediately on removal from the package. "Shelf" deterioration is more rapid and is countered either by use (exercise) or by restraint of the deteriorating agents. Both these aspects must be considered. The method prescribed by Ref 3 is a planned cyclic exercise of the equipment.

Dormant storage[13-15] is defined as that storage in which the materiel is packaged and/or preserved to prevent deterioration and is generally not ready for immediate issue without some deprocessing (see App D). It relies heavily on accepted methods of packaging and preservation that have little concern with a high state of operational readiness. Usually a substantial amount of time and work is required for the removal of preserving materials and preparation of the equipment for use, although time requirements might be reduced in an emergency, in view of the storage procedures developed by the maintenance groups.

Readiness Standard

The current readiness standard given in AR 220-10, "Deployment Serviceability Standards" section, requires that the item be "capable of performing at its rated capacity the function for which it was designed" for an estimated 90 days in combat "until major assembly replacement or fourth echelon repair can be effected in the operations area."[5] This definition is satisfactory for a using unit because the unit commander, within limits, can control the serviceability status of his equipment, but it is not sufficiently specific for the guidance of the custodial unit. The maintenance groups are using Seventh Army Circular 750-5[16] as the guide for operational readiness so far as prepositioned equipment is concerned. The Department of the Army is preparing 33 standards in the form of Supply Bulletins, most of which have arrived in the theater. Presumably these standards, reflecting the experience of the Ordnance Corps, will provide reasonable assurance of attaining the reliability status implied in the 90-day operational criterion. For the purpose of this study the readiness standard was divided into two parts—operational readiness and reliability.

Operational readiness for a vehicle is defined as the capability for starting it without trouble and moving it, fully equipped and with all components functioning properly, to the starting point as part of an operational unit. Operational readiness of the unit is defined as the percentage of vehicles operating as defined above.

Reliability is defined as the capability for performance for a designated period without major third-echelon maintenance. It is considered maximal

immediately after reconditioning or rebuilding, when the equipment has successfully met the imposed standards. Thereafter a decay process, consisting of three normal types of degradation sets, in: (a) exposure (while in storage); (b) performance test (exercise of the equipment, which has a feedback to lessen the effect of exposure, but which, in turn, reduces the effective life); and (c) operation (as in LT). Relative to c, the decay effect is overcome by requirements for complete after-operation inspections and reconditioning such that the equipment is returned to storage after again meeting the standards. Thus the process becomes cyclic. However, economic or effective life is reduced by operation, with a consequent effect on long-term reliability.

PROBLEMS, SYMPTOMS, AND ATTEMPTS AT SOLUTION

Prior to and concurrently with the initiation of this study in February 1963, an investigation of the prepositioning concept was conducted by the Seventh Army Support Command with the assistance of G4 section, Seventh Army. The TD units had been organized starting in July 1962 and had relieved the L&M units in September 1962. The TD personnel reported in at the beginning of what turned out to be an unusually severe winter. Working conditions at the majority of the sites were far from satisfactory, and morale problems had developed. Preparations for LT exercises seemed always to coincide with holidays. Sample records underscore the fact that few deficiencies were observed in the equipment, and considerable doubt existed about the conduct of the cyclic-exercise maintenance.

The investigation[4] showed among other things that the organization was not in balance, the administrative burden had appreciably reduced the capability of command and control, and the units were entirely dependent on other units for all essentials. In the personnel area the report called for a realignment and upgrading of the TD grade structure, personnel-space augmentation, and a recognition of the fact that supervisory personnel did not enjoy equivalent rank with counterparts in active units. From the standpoint of facilities the entire concept was challenged because of the criticality of space in Europe. Facilities were overcrowded; open storage, lack of adequate lighting, insecure warehouses, and an unplanned demand for interior guard invited pilferage; the need for hardstand and drainage was urgent; maintenance buildings were poorly lighted and unheated; and vehicle wash racks were limited, improvised, or nonexistent. It can be added that exercise areas in most cases were severely limited and latrines were at considerable distances from the working areas.

The existing solutions to the problem of maintenance—of the greatest importance to the concept—were vigorously attacked by the investigators. The workload was deemed to be of a size beyond the capabilities of the number of personnel assigned, the varied character of the types of maintenance requirements imposed still further problems, storage of the different classes of supply and supply items further complicated the situation, and skepticism of the efficacy of the maintenance procedures themselves was voiced.

Recommendations were for more skilled personnel, relocations (especially away from Spinelli), clearly defined standards of maintenance, and improvements in maintenance procedures.[4]

A number of formal and informal conferences have been held since inception of the concept to discuss the problems arising from the implementation and possible solutions. As late as the Ambassador-Commanders Conference, 14 Dec 62, four basic problems had not yet been solved satisfactorily.[17] Considerable uncertainty existed about maintenance standards for the equipment, the appropriate major command to be responsible for maintenance (subsequently settled as the Seventh Army), improvements to provide better maintenance support for prepositioned equipment located in France, and the propriety of the 14-day response-time limit.

Heidelberg Meeting

These problems were again discussed in the meeting held 21 Jan 63 at USAREUR HQ in Heidelberg and attended by representatives of HQ USAREUR, HQ Seventh Army, and US Army Communications Zone, Europe.[2] Since the discussions at this meeting shed considerable light on the problem areas and furnished important guidelines for the study approach, abstracts of the minutes of this meeting follow.

(1) Agreement is unanimous that the currently assigned organization (TD organizations) is inadequate.

(2) The Spinelli site must be improved or vacated.

(3) The IMG loses 1 month's maintenance for each LT exercise. This amounts to a 33 percent loss when LT is scheduled every 3 months.

(4) A P&P team will arrive in the theater 28 Jan 63 to study prepositioning.

(5) The 2d Armd Div will be converted to Reorganization Objective Army Division (ROAD) in July (concerns equipment of the AMG).*

The 4th Inf Div will be converted to ROAD in October (concerns equipment of the IMG).*

The proposed mix, 2d Div, was six tank battalions and five mechanized battalions. The proposed mix, 4th Div, was four infantry battalions, four mechanized battalions, and two tank battalions. The maintenance groups are presented with the problem of restationing and requisitioning equipment and, probably, of reorganization.

(6) Maintenance standards must be established for all equipment. The only one applying at the moment is AR 220-10, para 74 (Ref 5).

(7) The prepositioning concept should be expanded to include equipment for support units, principally tankers.

(8) Operation plans concerning issue of equipment are being revised.

(9) About 20 percent of the personnel of the IMG are disciplinary cases. The AMG is slightly better.

(10) The grade structure of the TDs is too low, and required skills are lacking.

(11) There are no civilian technical representatives, although some attempt is being made to get civilian personnel or labor groups.

(12) Standards on installations are very low and little money is available for improvement. Parking is in open fields, mostly mud. Space in quarters

*AMG and IMG conversions have not been completed as of this writing.

averages 40 sq ft/man instead of the prescribed 72 sq ft. The first implementation of the concept was considered temporary and under field conditions. The present application is on a permanent basis and the facilities thus become inadequate for this purpose. The estimated cost for minimum improvement was $800,000. Operation and Maintenance, Army (O&MA) funds can be obtained without difficulty in increments up to $25,000, but military construction, Army (MCA) funds may take from 3 to 4 years.

(13) At present, formal accounting is as general war reserves.[18] Seventh Army now has responsibility, but if DA approves formal accountability, the equipment will be turned over to the Stock Control Agency.[19] However, the maintenance groups do not have sufficient personnel to maintain adequately the records they now keep. Conversion to formal accounting will require augmentation by skilled supply accountants.

(14) The TD units are using prepositioned tools and equipment in their maintenance procedures. A supporting TA is urgently needed.

(15) An estimated 98 percent of the equipment could be moved to the assembly area, but much less could be moved into sustained combat.

(16) Only about 45 percent of the equipment issued to LT units gets into operation.

(17) Allegedly the Berlin Command overhauls all equipment (during the 3-month stay in Berlin) and puts it into good shape.

(18) The program of exercising requires much closer scrutiny.

(19) The 14-day limit was set because for anything over this period the completely equipped units could arrive by sea.

(20) A proposal was made for active units to exercise the equipment by field operation for prescribed periods.

LONG THRUST Conference

At an LT Conference, 29 Jan 63,[2] at the Support Command the impact of the LT VI on the prepositioned equipment was examined. The following items have been abstracted from the minutes of the meeting.

(1) Consideration should be given to a shift of mission assignments to relieve the IMG of some of its workload. Suggestions for reassignments of work details included airfield control and baggage details. The IMG is responsible for the complete staging of the incoming and outgoing battle groups comprising the LT elements; one-third of maintenance effort must be diverted to this purpose.

(2) A request was made that all technical services appoint a representative in matters concerning prepositioning.

(3) C-135B aircraft are employed in moving the battle groups, requiring from 21 to 22 sorties. Incoming movement was accomplished in 53 hr; outgoing, in 58 hr.

(4) The entire 1st Bn IMG and a good portion of the 2d Bn supported the exercise. The IMG commanding officer stated that the extra duties would have prevented issue to an entire division.

Before departure from the theater the P&P team proposed controlled-humidity storage (CH) as a long-term measure in preserving equipment. For the short range, the team recommended (a) a fogging (i.e., internal spraying

of preservative in the engine, including spraying a preservative over critical external components) procedure on wheeled vehicles and (b) cessation of exercise. On tracked vehicles no changes were recommended because of other installed components and because compilation of a preservation procedure or introduction of CH storage were pending. The detailed recommendation is contained in Tab J to the team's report.[20]

A much more detailed survey of the problem areas is contained in "Study of Prepositioned Equipment (U),"[4] together with recommendations made by the survey staff.

IMPLEMENTATION OF THE PREPOSITIONING CONCEPT

INITIATION OF THE RACFOE STUDY

On 11 Feb 63 the Commanding General (CG), Seventh Army, approved that portion of the RACFOE work program[21] that concerned prepositioning. The study had been proposed by Seventh Army Support Command and was the first study approved.

A "kickoff" conference was set up with the CG, Seventh Army Support Command, and was held 25 Feb 63 at Funari Barracks in Mannheim. At this conference it was learned that prepositioning may serve any one of three alternatives, (a) to equip the two-division force as originally contemplated, (b) to provide spares for the existing force in the event the airlift is not made, or (c) to equip an allied force, probably the German reserve.

A suggestion had been made by the Ordnance Officer, Seventh Army, that the equipment be placed in envelopes containing an inert gas. It was brought out during the conference that the P&P team had rejected this because of the high cost, but the CG pointed out that CH also appeared to involve high initial costs.

All equipment had been segregated into "company packages," i.e., all units of company size could expect to find all TOE in one location. This has the effect of lessening marry-up time but increasing required maintenance time. Segregation by Technical Service (TS) at each dispersed location might have the opposite effect, i.e., decreasing maintenance time but increasing marry-up time. The use of CONEX containers has been mentioned, but no data have been obtained.

During the conference the CG suggested that the cost of prepositioning will probably be most effectively measured in man-hours but the most important measurement of prepositioning effectiveness is reaction time.

The P&P team had recommended CH but, in addition to high installation cost, this solution creates a power problem because electric power is not available at a large number of the sites. The CG would like to explore the use of certain classified structures already built but apparently not in use.

Another bothersome but not acute problem was lack of uniformity in the property accounting system.

Conversion to ROAD occasions some reshuffling problems, but these are foreseen and planned for. The AMG started conversion on 1 Jul 63 and the IMG was scheduled to start about 1 Oct 63. Additional restationing problems may be created.

A problem exists in the storage of class I supply. The materiel must be rotated at relatively long intervals, and the custodial units cannot be expected to accomplish this rotation.

A class III problem exists—again one of rotation. A system of overstocking at supply points is being considered.

It was brought out that consideration should be given to a "self-help" type of issue that might improve the present procedure. The proposal is to set up a "country store" operation, in which the using unit travels from counter to counter to pick up equipment.

Considering all the foregoing, the conference presented the study group with a fairly complete exposition of the existing problem areas and the dynamic nature of the improvements program. It was also made quite clear that the comprehensive study of all the details would require much more time and effort than that available to the RACFOE study group.

OVERALL OBJECTIVE

The objective of the study as approved by the sponsor, G4, Seventh Army, is "to study current organizational structure, procedures, and practices to maintain the equipment in a combat-ready posture for possible improvement within USAREUR resources." The equipment referred to is the prepositioned materiel for one infantry division, one armored division, and ten combat-support units.

Scope

The scope of the study considered but was not limited to (a) possible variations in concept and organization; (b) effectiveness of maintenance and supply procedures; (c) adequacy of manning levels and skills; (d) locations of prepositioned equipment commensurate with activation during peacetime and wartime, with potential interference with missions of active units in Seventh Army; and (e) assets currently available within USAREUR.

Guidelines

According to guidelines furnished in the project proposal the CG, Seventh Army, considered the presence of prepositioned units necessary to the success of his mission. The existing program was austere in both facilities and personnel and could eventually overtax the capabilities of Seventh Army support units and interfere with the mission of the Seventh Army. For this reason an evaluation of the entire prepositioned program was necessary to effect improvements so that the goals of the program could be met in a more economical and efficient manner.

Mission of the Concept

From the standpoint of the prepositioning mission accomplishment, i.e., deployment of the force within 14 days after the start of war, six major conditions are necessary to success; the failure of any could completely defeat the purpose of prepositioning.

(1) The units being deployed must be able to assemble at home station and complete preparation for overseas movement (POM) within the prescribed time limt (D-day to D+8), including loading plans for aircraft.

(2) Sufficient aircraft and airfield facilities must be available close enough to the assembly area to mount the airlift in the prescribed time (D+8 to D+11).

(3) Sufficient reception facilities must exist in the theater to disembark the troops and transport them to the issue point without delay.

(4) Staging areas must be set up and ready at points where issue can be completed in the prescribed time (D+11 to D+14). These areas must be safe and secure in this period.

(5) Equipment must be operationally ready so that it can be moved to point of issue, D+11 to D+14 (or earlier), and into deployment. This also implies that the storage location is secure.

(6) Equipment must be sufficiently reliable to operate in the field with less than normal support until such support is established (estimated at 90 days).[5]

Items 1, 2, and 3 are considered beyond the scope of this study. It is also considered that a reliable estimate of operational readiness and reliability of the system may be obtained from a study of powered vehicles only, since they comprise by far the major portion of the prepositioned materiel and constitute almost the sole source of division mobility.

Study Objective

Specifically, therefore, this study has for its objective the study of all aspects of the system that may militate against the successful accomplishment of conditions 4, 5, and 6. This objective includes estimating the probability of their accomplishment and either recommending measures that will increase this probability or ascertaining the degree of risk associated with any specific readiness level below that of the average unit in the theater.

The essential elements of the study problem relative to 5 and 6 can be summarized as follows.

(a) What is the level of reliability achieved by the present resource allocation and how does this reliability compare with similar active units?

(b) If the level of reliability is significantly lower:

Can the redirection of existing resources to raise this level be justified with respect to the Seventh Army mission?

Can civilian labor be introduced as an added resource to achieve and maintain the proper level?

Should the concept be reduced in scope, retaining present custodial resources, so the proper level can be maintained?

APPROACH

Cost and Cost-Effectiveness

Consideration was given to the preparation of a cost-effectiveness analysis of the concept as presently implemented and with changes as introduced by

conversion to the ROAD reorganization. This analysis was not attempted because some direct costs (e.g., the initial allocation of $1,277,000 O&MA funds, $5,000,000 of MCA funds, and $3,800,000 funding for repair parts, tools, and other expendables) are easily identifiable but such costs as (a) capital investment less previous depreciation, (b) interest, (c) differences in depreciation emanating from the differences in active and dormant storage (and the additional cost of spare parts and repairs attributable to these same differences), (d) overhead costs, (e) obsolescence, and (f) certain transportation costs are difficult to identify without extensive audit and apportionment. Also, improvements already in process or recommended are not readily amenable to cost-effectiveness types of analysis because of the difficulty in evaluation of changes in custodial organization, locations, procedures, and reallocation of equipment to correspond to unit organizations under ROAD.

For these cogent reasons it was concluded that a cost-effectiveness analysis was not possible within the allotted time and would be in any event secondary to a determination of the probability of mission accomplishment. An analysis of this nature would prove of value only when reduction of funds for all military expenditures makes necessary a decision as to the retention of prepositioning.

Identification of Problem Areas

Studies[1,2,4] made prior to the initiation of the RAC project carefully outlined a number of problem areas and piecemeal solutions thereto, but none made available to the study team attempted to evaluate the effect of these problems on the primary mission. Realizing that these prior results could be symptomatic of much larger problems, the study team reevaluated them from the standpoint of character and degree of contribution to the military effectiveness of the system. The following subdivisions contain all the areas identified.

Personnel. All studies of the system included emphasis on the personnel problem facing the command echelons. During data collection many more complaints were voiced to the study team concerning lack of numbers, lack of quality, lack of skill, and lack of motivation.

The original request for 2500 trained personnel was purportedly based on standard planning factors but was reduced by DA to just under 2000. An effort to find the original planning factors used in the preparation of the TDs was unsuccessful.

The levy on active Seventh Army units for manpower was apparently an open invitation to unload unsatisfactory personnel, especially since this was not expressly forbidden. The Support Command study[4] states that about 20 percent of these men had disciplinary records. The levy also authorized selection at a grade lower than that required by the TD, which resulted inevitably in a level of skill somewhat lower than originally planned. In the lower ranks it could be expected that the proportion of ineffectives would be larger than average.

Thus the problem confronting the officer personnel is unusual and demands ingenuity, resourcefulness, and dedication well above normal. However, observation indicates that no personnel problem results entirely from the prepositioning concept itself.

Organization. The TD structure is not functional and quite obviously was not compiled on the basis of the anticipated workload (a problem the 1 Apr 64

reorganization may have solved). The maintenance groups made an effort to have assigned personnel trained in a more applicable MOS, but this is only a partial solution. If the composition of the custodial units is to be determined, the workload itself requires study.

Facilities. Lack of proper facilities is fully recognized as a major problem. However, the solution—more funds, space, and construction—is also well known, and correction is only a matter of time.

Maintenance Procedures. There is no reason to suspect maintenance procedures for nonautomotive materiel. Signal equipment seems to have a normal failure rate, but no provision is made for testing engineer-equipment generators against a load; in other respects storage procedures seem to be satisfactory.

At all echelons the complaints about prescribed exercise procedure identify this as a problem area.

Utilization of Personnel. The character of the workload and the misalignment of TD skills indicated a possible low utilization of the manpower potential. Determination of the actual workload and its characteristics is considered vital to the determination of the size and composition of the force on which this workload is imposed.

Condition of Equipment. The equipment to be prepositioned came from several sources: theater reserves; shipments (tanks) from Camp Darby, Italy; trade-ins from line units receiving more modern equipment; arrivals from CONUS depots; and contributions from the 4th Inf Div—a sizable share. Initially the general state of repair was very poor. Many vehicles had to be towed into position, and the tanks from Darby had to be stripped for tunnel clearances and arrived in knocked-down condition. Most of the trade-in equipment (M59s, M48A1s, M38A1s, etc.) had been in operation for several years. Supplies of spare parts for the limited standard items were no longer stocked in the theater and requisitioning for all other parts was in competition with that of active units. The reception workload of the L&M detachments was unquestionably large and gave little time for adequate preparation for storage.

In mid-1962, when the TD units relieved the detachments, they found evidence that the Q inspections preparatory to storage had not been thorough. Many deficiencies were discovered during the exercise process; when opportunity arose to perform a Q inspection the magnitude of the repair required could not be attributed exclusively to the storage period, to any minor operation to which the vehicle had been subjected, or to both.

Storage and Exercise Procedures. Maintenance Group SOPs[11,12] reflect the instructions received in the Seventh Army letter of 22 Jan 62[3] for the maintenance of prepositioned equipment. For powered vehicles several aspects of the current storage procedures could affect the issue condition of the equipment: (a) initial Q inspection only before storage or re-storage, (b) exercise procedure and the limits on movement, (c) preparation of vehicles for extended operation (issue), (d) number and character of uncorrected deficiencies, (e) maintenance surveillance inspections, and (f) shelf deterioration and aging.

These proposed procedures in lieu of exercise could also affect the issue condition of the equipment: (a) engine fogging, (b) dormant CH storage, and (c) "cocooning." The major research effort was devoted to the study of the aftereffects of current procedures.

Issue Procedures. The first mission of the maintenance groups is custodial care of the prepositioned equipment until D-day. At that time the mission changes abruptly, and the groups are then concerned with staging of the incoming units long enough to issue the equipment to them.

The bivouac areas for this latter mission have been selected and in the case of the IMG have been used to stage LT task forces. Preparation of the bivouac areas prior to arrival of troops* definitely reduces maintenance effort available to prepare vehicles for issue. Although the work is accomplished principally by personnel in the lower grades, the number of men required is inversely proportional to the amount of notice given and may cut heavily into the available mechanic manpower. On the other hand, advance preparation of the bivouac area discloses the site and lessens security.

Under LT a great deal of effort was required to account properly for the materiel and issue it in orderly prescribed fashion. An equal inventory workload was encountered during turn-in by the departing units. In a post-D-day situation most property accountability will be waived except for certain controlled items; however, the unit commander will still want an inventory of the items he receives. The necessity for a layout of equipment depends on the wishes of the commander and on the time and effort involved.

Siting. To derive maximum benefit from the prepositioning concept, the ideal is that storage locations be as close to the expected field of action as possible but with the lowest possible chance of being overrun during the 14-day critical period.[1] Space availability, political considerations, dispersion, and a number of other prevailing conditions were significant factors in influencing the decision to preposition in or to the west of the Rhine valley.

Since all choice locations were already occupied, the selection of sites became a relatively simple matter of taking what was left. As a result the sites were characterized by the lack of adequate hardstand, drainage, space, warehouses, and shops. Some improvements have been made in the situation, and further improvements are planned and in some cases funded.

The armored division and most combat-support units are in positions west of the Rhine; the infantry division is to the east. Under the reorganization to ROAD configuration, virtually all tracked vehicles of the infantry division will be prepositioned in Karlsruhe, to the west. When the CH method of preservation is introduced at some future date relatively few changes will be made in the present siting.

It must be assumed that a potential enemy has accurate knowledge of these locations and that a high degree of vulnerability to hostile attack exists. Operation BIG LIFT should furnish an opportunity for evaluation of this vulnerability.

Study Procedure

The small size of the study team enforced economy of effort, so the team decided to concentrate on the investigation of automotive vehicles because (a) vehicles constituted the bulk of prepositioned equipment; (b) vehicles subject to accelerated deterioration because of uncovered storage were therefore more critically sensitive to the storage process; (c) recordkeeping was apt

*As of BIG LIFT, this work is a responsibility of engineer units.

to be both continuous and substantial, since it was prescribed for all automotive equipment (the only materiel exercised); (d) automotive equipment was operated for lengthy periods during LT exercises; and (c) vehicles were the sole source of mobility prepositioned for the divisions and were therefore of high military value with respect to combat effectiveness.

Concentrating on automotive equipment, the study activities took the following form: (a) study of vehicle logs in the maintenance groups to determine parts and man-hours required for the Q inspection prescribed for placing vehicles in storage; third-echelon repairs (including parts and man-hours), and deficiencies discovered during exercise and corrected or remaining uncorrected; (b) study of vehicle logs in selected active units to obtain the same data, for comparison; (c) study of any operation of vehicles for maintenance data; (d) investigation of barrier material used in preserving large items; (e) study of the utilization of manpower, with respect to vehicles, in accomplishing the custodial mission and the workload associated with that mission; and (f) observation of all other aspects to attempt to identify any other problem areas.

DATA SOURCES

At the time this study was initiated the only obvious data sources were the records kept by the maintenance groups. The quality of the records for statistical purposes depended entirely on the degree of experience and efficiency possessed by the recordkeeper and as a result much of the information was incomplete, inconsistent, or sometimes completely undecipherable.

Exercise Procedure

Until June 1963 the standard procedure prescribed by the maintenance group SOP[11,12] was to exercise the prepositioned vehicles on a biweekly basis. The extent of the exercise varied between kasernes. Most storage locations were severely cramped and the vehicles could be moved forward only one or two lengths and returned to position. A few sites had enough space to drive the vehicles around the park.

During and after the exercise a visual check for deficiencies was made. Study of the reported deficiencies indicates that the extent of this inspection was highly variable but for the most part probably cursory; unless the vehicle failed to start only items pilfered or accessory-type deficiencies were reported.

It was not necessary for the man exercising the vehicle to record whether the vehicle started, or how much difficulty he experienced in starting it. Most repairs that he had to perform were first-echelon work on which recordkeeping was not required. For second-echelon work records were kept only on vehicles requiring parts that were not available at the time of repair.

With the exception of one site, where data on about 30 vehicles were found, the exercise program yielded no data for operational readiness. Because of this condition the sampling process became one of selection of case histories that could be considered reasonably complete, and much of the randomization desirable for statistical sampling was lost. Time and manpower requirements for the examination of the records of the entire fleet of 7000 vehicles

were prohibitively high and the promise of significant results was too small to justify such examination. As a result the conclusions relating to the exercise procedure cannot be considered completely firm. The estimation of operational readiness from this source or the assessment of the efficacy of the exercise procedure cannot be drawn from these data with complete confidence.

Long Thrust

Among the LT missions were (a) testing airlift capabilities and (b) giving some of the prepositioned vehicles extended usage: an infantry battle group was flown from CONUS to Germany, drew its equipment, and 10 days later marched to a training area. The battle group participated in a short field training exercise (FTX), remained at a training area (usually Wildflecken) for 3 months, and then moved to Berlin for another 3 months. Following the Berlin tour the battle group returned to the proximity of the IMG, turned in its vehicles, and returned to CONUS.

TABLE 5

LONG THRUST Units, Length of Stay in Theater

LT	Arrival date	Departure date
I	—	—
IIA	—	—
III	7 May 62	14 Oct 62
IV	9 Jul 62	14 Jan 63
V	2 Oct 62	7 Apr 63
VI	14 Jan 63	8 Jul 63
VII	7 Apr 63	22 Oct 63
VIII	18 Jul 63	19 Feb 64
IX	10 Jan 64	10 Apr 64[a]
X	11 Feb 64	10 Apr 64[a]

[a]The return of these units was designated LT XI.

Each vehicle, before issue to an LT unit, was given a preparatory Q inspection—[after 1 May 64, a semiannual (S) service.][22] After this preparatory maintenance virtually all the vehicles (approximately 266 were involved, including support elements in each LT) were ready for operation and could start the march to the training area. However, this was no measure of true operational readiness because the maintenance units had ample time to prepare the vehicles for issue (i.e., about 3 months). No data were kept on how many of the vehicles were driven to the maintenance shop, how many were towed, or how many were repaired on the spot. This would have provided realistic data on operational readiness.

Since it is impossible to determine reliability of the equipment without extended operation, LT promised to be the sole source of this appraisal (see Table 5). Very little data were available from LT III and none from LT IV.

The first available data of any consequence came from LT V, but these were incomplete and largely incomprehensible. An excellent report compiled by LT VI lacked some vital details unobtainable from records currently maintained. The first LT unit placed under some form of statistical control was LT VII; LT VIII was the last LT of battle-group size, and data on the preparation as well as the operation were obtained from this exercise. Data from these last two LT exercises form the major basis of the analysis that follows.

LONG THRUST exercises furnished some data on reliability, and the records of about 800 vehicles are reasonably complete. These 800 vehicles have been used in LT, and each has gone through extensive inspection and repair before issue. The available records of all these have been used in the determination of reliability. The sample is not random but is considered of ample size for valid inference.

Seventh Army Line Units (Control Group)

Data from several line units in Seventh Army were required as a control for LT data. Information was gathered from infantry battle groups so that a standard could be developed for the meaningful analysis of the reliability of the prepositioned equipment. A basic 3-month period was used, corresponding to the duration of LT at Wildflecken, and included an FTX. Every attempt was made to remove parametric differences and to ensure similarity of the operation.

AMG Road Marches

The AMG conducted two sets of road marches in 1963. The first set, Short Thrust I, conducted between January and April, was made because the initial Q maintenance performed on the vehicles when they were first placed in active storage was considered inadequate and maintenance-group SOPs prohibited performance of another Q without operation of the vehicles per instructions in LOI.[3] By marching the vehicles an extended distance (100 miles for wheeled, 25 to 40 miles for tracked), the AMG could properly perform another Q maintenance, presumably to their satisfaction. Valuable data on operational readiness were obtained from these marches, since nonstarts were listed on reporting forms. No data on reliability were available, however, since the reports did not provide data on maintenance effort required by the vehicles after the marches.

The second set of marches was conducted in preparation for BIG LIFT during the period 15–25 Jul 63. The initial policy adopted for preparing the prepositioned vehicles was a road march (again, 100 miles for wheeled, 25 miles for tracked) followed by a semiannual inspection; presumably the vehicles would then be RFI. The procedure was given the designation Short Thrust II and was considered an opportunity to collect data on vehicles placed into operation directly off the park. Reporting forms were prepared to collect data on operational readiness but were not used, since Short Thrust II was discontinued after only 10 days because of an excessive failure rate. Records of what occurred during and after the marches could be obtained but unfortunately no data were available on how many vehicles did not start. These records, however, provided much useful data on reliability.

Operation BIG LIFT (Short Title: BIG LIFT)

BIG LIFT is the name assigned to the operation in October-November 1963 in which the personnel and individual equipment of an entire armored division were airlifted from CONUS to the prepositioning sites, joined with prepositioned equipment, and deployed for engagement with a simulated aggressor force.

As the first instance of use of prepositioned armored equipment, the operation itself promised to provide the desired quantity of information on the prepositioning concept. Each infantry battle group on LT had nine tracked vehicles, but these were shipped to the exercise area and saw extremely limited use.

Most important, however, information on the reliability of vehicles given a very extensive preparatory maintenance should be provided. The vehicles issued to BIG LIFT may have undergone a higher-level maintenance preparation than was recorded during LT exercises. The relation between time spent on preparatory maintenance and reliability will be discussed in the section on "Reliability" in the next chapter.

This report does not include an analysis of BIG LIFT. Data were collected on BIG LIFT (as authorized by CG, Seventh Army) but the analysis will be submitted as a separate report.

Previous Studies

Previous Army studies served to rapidly verify the problem areas and to sum up proposed solutions to problem segments. Much of the background of the implementation was also derived from these. Several RAC studies[23–26] proved of value.

Barrier Materiel

A proposal for storage of the vehicular equipment, including a major portion of on-vehicle materiel (OVM), in plastic envelopes was investigated by letter queries to potential manufacturers, but the effort proved abortive because there was no indication that an extensive cocooning of this sort had ever been attempted. An investigation of this method of preservation may be fruitful, but it is outside the scope of this study because of its developmental nature.

Comparable Units

Work performance of other TOE units comparable in workload and composition to the mission of the custodial groups established a work performance standard for comparison. A CLG was also studied; it opened an avenue for the reduction of operational costs. The payroll of this unit was also examined to evaluate the impact on gold outflow if such a unit were used for the custodial mission.

CHANGES DURING STUDY

During the course of this portion of the study (from initiation to 31 Jul 63), effort to improve the application of the prepositioning concept has been constant; some of the attempts resulted in radical change from the initial situation.

TABLE 6

Approximate Distribution of Powered Vehicles in ROAD Armored Division TOE, 31 Jul 63

(Includes requisitioned shortages, excludes excesses)

Vehicle	Distribution: D'Isley (Pirmasens)						Germersheim					Kleber (Kaiserslautern)						Daenner (Kaiserslautern)						Chenevières					Rhine Ordnance Barracks*						Ramstein		Div Total
	Mech	Mech	Eng	Sig	BHq	Total	Tk	Tk	Tk	BHq	Total	Mech	H Div	MP	Adm	MI	Total	Tk	Tk	Cav	Mech	BHq	Total	Av	Med	H Sup	S&T	Total	105 SP	105 SP	105 SP	155 SP	Arty Hq	Total	Mar	Total	
Carrier																																					
Mortar, 4.2, SP	5	5				10	5	5	5		15	5					5	5	5	9	5		24														54
Personnel	66	66	40		8	180	20	20	20	8	68	66	2				68	20	20	33	66	8	147						11	11	11	8		41			504
Howitzer,																																					
105-mm, SP																													18	18	18			54			54
155-mm-8-in., SP																																22		22			22
Launcher, bridge, M48			4			4	2	2	2		6							2	2				4														14
Tank																																					
Lt gun	2	2				4	2	2	2		6	2					2	2	2	23	2		29														41
Med gun							54	54	54		162							54	54				108														270
Rec Veh	5	5	2			12	5	5	5		15	5					5	5	5	5	5		20						2	2	2	2		8	4	4	64
Tractor, LS, diesel, med			21			21																															21
Total tracked	78	78	67		8	231	88	88	88	8	272	78	2				80	88	88	70	78	8	332						31	31	31	32		125	4	4	1044
Truck																																					
Amb, ¼-ton	3	3	1			7	4	4	4		12	3	2				5	4	4	3	3		14						1	1	1	1		4	4	4	46
Util, ¼-ton	37	37	43	24	27	168	34	34	34	27	129	37	26	8	13	10	94	34	34	72	37	27	204	17	22	9	16	64	30	30	30	20	17	127	28	28	814
Util, ¼-ton, 106-mm	6	6				12						6					6				6		6														24
Amb, ¾-ton																									48			48					1	1			49
Cargo, ¾-ton	17	17	11	73	7	125	10	10	10	7	37	17	3	3	6	2	31	10	10	14	17	7	58	28	14	4	15	61	26	26	26	33	34	145	25	25	482
Cargo, 2½-ton	9	9	40	75	5	138	17	17	17	5	56	9	5	3	5	2	24	17	17	25	9	5	73	20	42	4	83	149	20	20	20	22	11	93	126	126	659
Shop van, 2½-ton	2	2	1			5						2	8		2		12			2	2		4	7		2		9	1	1	1	1	3	7	32	32	69
Tank, 2½-ton	4	4	7	2	1	18	6	6	6	1	19	4					4	6	6	10	4	1	27	10			6	16					1	1	4	4	89
Trctr, 2½-ton																																			10	10	10
Cargo, 5-ton	10	10				20	17	17	17		51	10					10	17	17	17	10		61						17	17	17	29	1	81			223
Dump, 5-ton			35			35																															35
Med wkr, 5-ton	1	1	1	1	1	5	3	3	3	1	10	1					1	3	3	3	1	1	11	1			3	4	1	1	1	1		4	13	13	48
Brdg Transp, 5-ton			53			53																															53
Trctr, 5-ton																											31	31							16	16	47
Trctr wkr, 5-ton																																			1	1	1
Trctr, 10-ton			10			10																													6	6	16
Util, ¼-ton, Davy Cr	1	1				2	1	1	1		3	1					1	1	1	1	1		4														10
Grader, road			4			4																															4
Loader, scoop-type			12			12																															12
Total wheeled	90	90	218	175	41	614	92	92	92	41	317	90	44	14	26	14	188	92	92	147	90	41	462	83	126	19	154	382	96	96	96	107	68	463	265	265	2691
Total vehicles	168	168	285	175	49	847	180	180	180	49	589	168	46	14	26	14	268	180	180	217	168	49	794	83	126	19	154	382	127	127	127	139	68	588	269	269	3735

*Honest John arty bn not included.

TABLE 7

Approximate Distribution of Powered Vehicles in ROAD Infantry Division TOE after Conversion

Vehicle	Distribution: Spinelli (Mannheim)																Neureut (Karlsruhe)								Germersheim												Div Total	On hand	Excess	Short
	Inf	Inf	Inf	Inf	Inf	Sig	S&T	HSC	BHq	BHq	BHq	Mat	MP	DivH	Adm	Total	Arty Hq	105	105	105	8 in 155	Eng	Av	Total	Mech	Tk	Tk	Cav	BHq	BHq	BHq	Mat	Med	Eng	Div Hq	Total				
Carrier																																								
Mortar, 4.2, SP																									5	5	5	9								24	24	9		15
Personnel, M59																—		11[b]	11[b]	11[b]	8[b]			—	66	30	20	33	8	8	8				2	206	306	176		30
Howitzer																																								
105-mm SP, M52																—		18	18	18				54												—	54	12		42
155-mm,8-in., SP, M44, M55																—					22			22												—	22	0		22
Launcher, bridge, M48 chassis									a	a	a	a		a		—						a		—		2	2							4		8	8	3		5
Tank																																								
Lt gun, M41																—								—	2	2	2	23								29	29	29		—
Med gun, M48																—								—		54	54									108	108	92		16
Recovery veh, M88																—		2[b]	2[b]	2[b]	2[b]			—	5	5	5	5				4		2		34	34	17		17
Tractor, LS, med																—								—										21		21	21	14		7
Combat engr veh, 118E1																—								—										4		4	4	0		4
Total tracked	—	—	—	—	—	—	—	—					—		—	—		18	18	18	22			76	78	88	88	70	8	8	8	4		31	2	434	510	382	30[c]	158
Truck																																								
Amb ¼-ton, M170	6	6	6	6	6							4		2		36		1	1	1	1	1		5	3	4	4	3								14	55	60	5	
Util ¼-ton, M38	44	44	44	44	44	24	16	9	27	27	27	28	8	26	13	125	17	30	30	30	20	43	17	187	37	34	34	72					22			199	811	607		204
Amb, ¾-ton, M43																	1							1									48			48	49	38		11
Cargo ¾-ton, M37	42	42	42	42	42	73	15	4	7	7	7	25	3	3	6	360	34	26	26	26	33	11	28	184	17	10	10	14					14			65	609	459		150
Cargo 2½-ton, M34, M35	17	17	17	17	17	75	83	4	5	5	5	126	3	5	5	401	11	20	20	20	22	40	20	153	9	17	17	25					42			110	664	448		216
Lt wkr, 2½-ton, M60, M108																								—												—	—	4	4	
Shop van, 2½-ton, M109	1	1	1	1	1	2		2				32		8	2	51	3	1	1	1	1	1	7	15	2	6	6	2								16	82	22		60
Tanker 2½-ton, M49, M217	2	2	2	2	2		6		1	1	1	4				23	1						10	11	4			10								14	48	37		11
Tractor 2½-ton, M275												10				10								—												—	10	11	1	
Cargo, 5-ton, M54																	1	17	17	17	29			81	10	17	17	17								61	142	98		44
Dump, 5-ton, M51																						35		35												—	35	58	23	
Med wkr, 5-ton, M62, M543	1	1	1	1	1	1	3		1	1	1	13				25		1	1	1	1	1		5	1	3	3	3								10	40	34		6
Brdg transpt, 5-ton																						53		53												—	53	9		44
Tractor, 5-ton, M52							31					16				47								—												—	47	20		27
Tractor wkr, 5-ton, M246												1				1								—												—	1	1		—
Cargo, 10-ton																								—												—	—	8	8	
Tractor, 10-ton												6				6						10		10												—	16	2		14
Util, ¼-ton, 106 rifle	8	8	8	8	8											40								—	6											6	46	30		16
Util, ¼-ton, Dass Cr	3	3	3	3	3											15								—	1	1	1	1								4	19	0		19
Loader, scoop-type																						4		4												—	4	8	4	
Grader																						12		12												—	12	4		8
Total wheeled	124	124	124	124	124	175	154	19	41	41	41	265	14	44	26	1440	68	96	96	96	107	211	82	756	90	92	92	147	—	—	—	—	126	—	—	547	2743	1958	45	810
Total vehicles	124	124	124	124	124	175	154	19	49	49	49	269	14	46	26	1440	68	127	127	127	139	212	82	812	168	180	180	217	—	—	—	—	126	—	—	981	3253	2340	75	988

[a] Tracked vehicles at Germersheim.
[b] At Germersheim.
[c] High-speed tractors.

Restationing

Relatively few restationing changes were made before the ROAD conversion. In the AMG the equipment at Pulaski-Kapaun Kaserne was moved to the Ramstein Cold Storage Area, and then the equipment at Ramstein and the equipment of the ordnance battalion at Daenner were interchanged. However, the conversion to ROAD occasioned several significant restationing changes in the distribution of equipment. Starting 1 Jul 63, the AMG redistributed available equipment approximately as shown in Table 6. Items in short supply have been requisitioned but a shortage may be expected to exist for some time. Based on an armored division containing five tank battalions and four mechanized battalions (the size of the 2d Armd Div in BIG LIFT), the excess amounted to 240 vehicles and the shortage to 370, with negligible substitutability.

The IMG has a much greater problem because of the greater number of vehicles involved (a net increase of approximately 1000). The new mechanized division will substantially increase the number of vehicles to be requisitioned, the workload, and the demand for parking area. The conversion, scheduled for 1 Oct 63, is still under way at this writing and may have a considerable impact on the workload and composition of the IMG. Table 7 was compiled to illustrate the problems confronting the IMG and the distribution of equipment at the sites now available.

Packaging and Preservation

Implementation of the P&P-team recommendations was directed in February 1963. In May 1963 fogging was demonstrated at Spinelli on 25 vehicles, which were removed from the exercise program and are currently stored in the vehicle park. At this writing, insufficient time has elapsed for evaluation of this experiment and no data have been made available on the condition of the vehicles prior to fogging, but seven fogging machines had been received in the theater and an extensive program of fogging was directed; as of July 1964 all vehicles are fogged as part of the S service. The hoped-for result of this procedure was the elimination of the exercise program and, to a considerable extent, reduction in the amount of semiannual maintenance required; the exercise procedure was discontinued 22 Jul 63.

The long-range recommendation of the P&P team for CH warehouses has been implemented to the extent that site surveys have been made, warehouses of suitable size have been proposed for each site, and funds have been requested for the purpose.

ANALYSIS AND RESULTS

PERSONNEL

Manpower Utilization

The work potential of a unit with respect to its personnel is defined as the man-hour availability for a specific task. By estimating or measuring the man-hour requirements generated by the task and comparing this with man-hour availability, a satisfactory representation of the efficiency with which manpower is utilized is obtained in the form of a ratio, or index. For convenience in comparison the index base was taken as 1.00 for workload demand exactly equal to man-hour availability. These indexes will be designated "Utilization of Potential Index" (UPI) (see App C).

The workload demand can be computed from known work performance standards and the mission, or it can be measured or estimated over a period of time. For regularly authorized TOE units the former is generally applicable. In the case of the custodial unit no standards had been set, and it was necessary to estimate the workload by using empirically determined factors and the theoretical distribution of manpower derived from the TDs. Only direct automotive personnel were used in estimating the workload developed in Table 8. The results concern 1073 direct labor personnel of the total strength of 1999 and imply a similar workload on that proportion of overhead assigned to the automotive section—392, or a total automotive strength, including overhead, of 1465. A portion of the driver potential was diverted to in-storage maintenance of other-than-automotive equipment.

The UPI is an approximation based on recorded averages of 8.2 man-hours/Q inspection, 36 man-hours per year per vehicle on exercise, and the extra workload created by LT exercises. If an upper limit of 17 to 20 man-hours/Q inspection is used, the UPI will be increased accordingly (see "Extent of Preparatory Maintenance" in the later subsection "Reliability").

Details of the additions to the workload at Spinelli Barracks caused by these LT rotations are given in Table 9. The estimates are obtained by averaging samples taken from LTs III, V, VI, VII, and VIII. On this basis the derived index for the whole custodial unit for the 1-year period lies between 0.27 and 0.35 (variation due to fluctuating manpower usage). The index of 1.00 is achieved only in the instance where workload-arrival rate is constant and is equal to the constant service rate. Because vehicles fail randomly the arrival rate is never constant, and a unit designed for a UPI of 1.00 will eventually tend to work a backlog of infinite size. The practicable UPI is in the neighborhood

TABLE 8

Estimated Direct Workload on Powered Vehicles, 1 Aug 62–31 Jul 63

(Based on initial distributions)

Distribution	Tracked vehicles	Wheeled vehicles	Personnel				Computed workload, man-hours																	Efficiency index = demand / available
							Available[a]					Demand, other than exercise				Demand, exercise[b]				Total					
			Wheeled		Tracked		Wheeled		Tracked		Total	Wheeled		Tracked		Wheeled		Tracked		Wheeled[c]		Tracked		Total	
			Drivers	Mechanics	Drivers	Mechanics	Drivers	Mechanics	Drivers	Mechanics		Drivers	Mechanics	Drivers	Mechanics	Drivers	Mechanics	Drivers	Mechanics	Drivers	Mechanics	Drivers	Mechanics		
IWG[f]																								
Spinelli H&H Det IWG			d									e		f		g	h	d	h					
1st Inf Maint Bn Hq																								
Inf Maint																								
Co A	8	162	14	11	—	1	17,640	14,680	—	1,260		4,264	3,774	—	320	1,944	1,750	384	43	4,208	5,524	384	363		
Co B	8	162	14	11	—	1	17,640	13,680	—	1,260		2,264	3,720	—	320	1,944	1,750	384	43	4,208	5,470	384	363		
Co C	8	162	14	11	—	1	17,640	13,680	—	1,260		4,459	5,768	—	640	1,944	1,750	384	43	6,403	7,518	384	683		
Armd Cav Maint Co	59	98	7	5	10	10	8,820	6,300	12,600	12,600		1,372	—	1960	—	1,176	1,058	5,664	637	2,548	1,058	7,624	637		
Tk Maint Co	114	92	12	6	14	19	15,120	7,560	17,640	23,940		2,352	—	2744	—	1,104	994	10,944	1,231	3,456	994	13,688	1,231		
Sig Maint Co	—	177	—	8	—	—	—	10,680	—	—		—	—	—	—	2,124	1,912	—	—	2,124	1,712	—	—		
Trans Maint Co	117	114	20	3	—	30	25,200	3,780	—	37,800		3,920	—	—	—	1,368	1,231	11,232	1,264	5,288	1,231	11,232	1,264		
QM Maint Co	—	57	3	3	—	—	5,040	3,780	—	—		784	—	—	—	684	616	—	—	1,468	616	—	—		
Total	302	1024	85	58	24	62	107,100	73,080	30,240	78,120	288,540	17,415	13,262	4704	1,280	12,288	11,061	28,992	3,261	29,703	24,323	33,696	4,541	92,263	0.32
On hand, qualified[f]	336	1034	55	60	20	53	69,300	75,600	25,200	66,780	236,880									120	96	2,304	230	95,013	0.40
Nearest	80	934	7	63	1	14	8,820	79,380	1,260	17,640	107,100	860	1,819	—	—	11,208	10,087	7,680	864	12,068	11,506	7,680	864	32,118	0.33
AMG																									
Kleber	89	218	14	9	17	10	17,640	11,340	21,420	12,600	63,000	715	715	294	1,424	2,616	2,354	8,544	961	3,331	3,069	8,838	2,385	17,623	0.28
D'Iales	252	582	21	31	35	32	36,960	19,060	44,100	40,320	139,940	1,909	1,909	832	4,032	6,984	6,286	24,192	2,722	8,893	8,195	25,024	6,754	48,866	0.28
Germersheim	206	238	10	12	44	29	12,600	15,120	55,440	36,540	119,700	781	781	680	3,296	2,856	2,570	19,776	2,225	3,637	3,351	20,456	5,521	32,965	0.28
Rhine Ord Barracks	116	478	17	16	33	18	21,420	20,160	41,580	22,680	105,840	568	1,568	383	1,856	5,736	5,162	11,136	1,253	7,304	6,730	11,519	3,109	28,662	0.27
Chenevières	—	332	13	17	1	—	16,380	21,420	1,260	—	39,060	1,089	1,089	—	—	3,984	3,586	—	—	5,073	4,675	—	—	9,748	0.25
Baenner	297	535	27	46	64	39	34,020	57,960	80,640	49,140	221,760	1,755	1,755	980	4,752	6,420	5,778	28,512	3,208	8,175	7,533	29,492	7,960	53,160	0.24
Pulaski-Kapaun	87	94	7	5	17	9	6,300	6,300	21,420	11,340	45,360	308	308	267	1,392	1,128	1,015	8,352	940	1,436	1,323	8,619	2,332	13,710	0.30
Combat support group																									
Chenevières	58	542	28	31	22	—	35,280	49,060	27,720	—	102,060	—	—	—	—	6,504	5,854	5,568	626	6,504	5,854	5,568	626	18,552	0.18
Gerszewski	95	105	10	6	18	15	12,600	7,560	22,680	18,900	61,740	—	—	—	—	1,260	1,134	9,120	1,026	1,260	1,134	9,120	1,026	12,540	0.20
Turley	—	228	13	23	—	—	16,380	28,980	—	—	45,360	1,120	1,848	—	—	2,736	2,462	—	—	3,856	4,310	—	—	8,166	0.18
Total											1,349,460	27,520	24,654	8160	18,032	63,720	57,349	151,872	17,086	91,240	82,003	160,032	35,118	368,393	0.27[h]

[a] Based on 1,260 hrs man yr available

[b] 24 exercises scheduled per vehicle per year

[c] IWG: Includes all LONG THRUST work (Q of turned in vehicles, inventory, reception, etc.)

[d] 3.0 man-hours per exercise per tracked vehicle

[e] 8.2 man-hours per Q per vehicle wheeled.

[f] 40 man-hours per Q per vehicle tracked

[g] 0.5 man-hours per exercise per wheeled vehicle

[h] 0.3 def per vehicle per exercise + 1.5 man-hours correction

[i] Check of qualified personnel at Spinelli

[j] AMG: 0.4 of vehicles operated for 1 day then O'd during year

[k] On the basis of Spinelli sample this would be 0.35

TABLE 9

Impact of LONG THRUST Exercises on Workload at Spinelli Barracks

Period	Preparing maintenance company	Unit to CONUS	Unit from CONUS	Days						Exercise days[g]					
										C		B		A	
				Total[a]	Inventory[b]	Movement[c]	Reception[d]	Q[e]	Bivouac[f]	Mechanic	Driver	Mechanic	Driver	Mechanic	Driver
1962															
14 Mar–13 May	L&M		LT III	—	—	—	—	Pre-issue — Turn-in			N/A				
14 May–15 Jul	L&M		LT IV	—	—	—	—				N/A				
1 Aug–8 Oct	C	LT III	LT V	49	21	2	3	C 35	10	14	16	49	49	49	49
9 Oct–2 Nov				17						17	17	17	17	17	17
1963															
3 Nov–20 Jan	B	LT IV	LT VI	54	18	2	3	B 34 C 35	10	19	19	20	21	54	54
21 Jan–27 Jan				5						5	5	5	5	5	5
28 Jan–13 Apr	A	LT V	LT VII	55	20	1	2	A 35 B 35	10	55	55	20	20	20	22
14 Apr–21 Apr				5						5	5	5	5	5	5
22 Apr–25 Jul	C	LT VI	LT VIII	68	16	2	1	C 37 A 35	10	31	39	68	68	33	33
25 Jul–31 Jul				4											
Total				257						146	156	184	185	183	185
Days lost										111	101	73	72	74	72

[a]The total workdays spent by IMG.

[b]Days required by the advance party for inventory.

[c]Days required to airlift the battle group to Europe.

[d]Days required to receive the incoming troops and issue equipment to them.

[e]Days required to perform the Q inspection, either preissue or for preparation for return to storage after turn-in. Letter designates the preparing maintenance company.

[f]Days the battle group spent in bivouac before movement to the training area at Wildflecken. (After 3 months at this location, the unit moved to Berlin for another 3 months, after which they returned directly to the storage area.)

[g]Days spent in the exercise and maintenance during the period designated.

of 0.80. In war, workload is a function of the situation and the unit must be designed for the maximum condition. Clustered workloads have led to indexes as low as 0.40 to 0.50, varying inversely as the distance from the forward edge of the battle area (FEBA). The effect of the variations in daily strength caused by casualties or the receipt of replacements also contributes to this low index. In war the planned MOS productive time is 168 hr/month.[27] In peace this becomes 105 hr/month, leading to indexes from 0.60 to 0.80 for the same support mission.*

Maintenance Groups

The TDs established three maintenance groups for custodial care and active storage of the prepositioned equipment. As of 1 Apr 64, these were combined into one group. The automotive portion, according to the TDs, is composed of 1465 men, including overhead. Combining these, the ratio of men to vehicles becomes 1 to 4.8. For organizational maintenance SR 310-30-15 states: "Mechanics are authorized on the following basis: In companies or comparable units, one for 12 wheeled vehicle equivalents (approximately 10 vehicles) . . . for company level organizational maintenance."[27]

An additional mechanic is authorized in headquarters or service companies for each 30 WVE for battalion or higher-level organizational maintenance.

These, of course, are for operating units. Aggregating, this becomes seven mechanics per 50 vehicles or one mechanic per seven vehicles to meet the requirements for organizational maintenance. With overhead included this becomes one man per 5.3 vehicles, roughly comparable to the maintenance-group manning.

The computed workload of the automotive section of the maintenance groups for a year was 368,000 man-hours (see Table 8). This is a direct workload on mechanics and drivers only, without overhead. Since the proportion of overhead is about the same in all units the index for direct labor can be assumed to represent the index for the entire automotive group.

Several factors operate to increase the normal workloads: substandard items in the prepositioned materiel, maintenance of trailers, reduction of level of skill and performance, working conditions, dispersion resulting in travel time, and the staging and issue mission.

*As an illustration of the UPI, using the values from SR 310-30-15,[27] the Direct Automotive Support (DAS) Co TOE 9-127,[28] an arbitrarily selected unit, has UPIs of

$$\frac{1269 \text{ WVE} \times 25 \text{ man-hours per job} \times .25 \text{ of supported vehicles per month}}{118 \text{ men} \times 168 \text{ hr/month}} = 0.40 \text{ wartime}$$

$$\frac{1269 \text{ WVE} \times 25 \text{ man-hours per job} \times .25 \text{ of supported vehicles per month}}{118 \text{ men} \times 105 \text{ hr/month}} = 0.64 \text{ peacetime}$$

where WVE = wheeled-vehicle equivalents (1269 WVE = approximately 1000 vehicles)
.25 = estimated percentage of supported vehicles in shop per month
25 man hours = estimated time required to make the average repair
168 hr/month = estimated MOS time available in wartime
105 hr/month = estimated MOS time available in peacetime (computed)

The DAS Co TOE 9-127P[29] has a slightly improved UPI: wartime, 0.47; peacetime, 0.76.

Conversion to ROAD will increase the workload about 17 percent. The introduction of an expanded maintenance program will increase the workload still further. Table 10 gives the approximate military manning for various levels of UPI and maintenance programs. Table 11 gives the CLG manning for comparable conditions. Figure 1 illustrates the requirements for military mechanics for selected levels of maintenance.

The Ordnance Park Co[30] is the only TOE unit with a mission similar to that of the maintenance groups. This unit stores vehicles and OVM in much the same manner as the maintenance groups, performing storage maintenance only and with a planned turnover every 30 days. With 1800 vehicles (including artillery), the workload consists of receiving, inspecting, storing, in-storage maintenance, preparation for issue, and issue of RFI vehicles as required. The ratio is 1 man to 11.5 vehicles (including overhead) on a monthly basis. The proposed Park Co[31] has a strength of 123 men with a 1200-vehicle workload—a ratio of 1 man to 9.8 vehicles per month. However, the similarity ends when it is considered that little deterioration can be expected in 30 days and that the vehicles have been in operation and are presumably in operable condition when received.

Civilian Labor Group

The CLG presents some important possibilities. The unit studied is the 8902d CLG (DAS) stationed at Funker Kaserne, Esslingen, a company similar to TOE 9-127,[28] with a strength of about 150 CLG and 40-plus local wage rate (LWR) personnel. Although this unit performs only third-echelon work, the potential for custodial maintenance can be inferred. A great many of the men have 10 or more years' service in the unit. The LWR have civil-service standing and all those in the unit at this writing have been there for a considerable time. They are much older than the CLG and have a higher absence rate. As they quit or retire the space is dropped and a CLG space is opened. The LWR are not as easily handled, administratively, as the CLG: it is difficult to send them on travel, and they have a higher wage rate but are not given the fringe benefits of the CLG.

The CLG must qualify in arms, undergo Army training tests, put in 1 hr/week in training, stand alerts, and participate in FTXs. The unit is designed to be 100 percent mobile, but because of the accumulation of bulky parts it possesses only about 85 percent mobility. The younger men are subject to draft into the Bundeswehr and are given unpaid leave for this purpose. All men can resign on 14 days' notice.

On entering the unit each man receives 48 hr of basic training and on-the-job training for 3 months. Vacancies permitting, the man may be raised in grade or demoted at the discretion of the superintendent. Space and grade allocations for the unit are permanent.

Although it is a mobile unit, the CLG at Funker Kaserne has several shop buildings in which it can park and supply vehicles and work partly out of the trucks and partly from benches. At present this unit has the mission of third-echelon direct automotive support for 2667 vehicles, or 3100 WVE.

Performance and Workload. An inspection of the shops indicated an excellent state of discipline and morale. All were clean, neat, and orderly in all respects. The unit has received a number of "Superior" awards.

TABLE 10

Original Estimate of Approximate Military Manning Required for Various Levels of Maintenance after ROAD Conversion

(Preservation time included; 6-month cycle assumed)

	Mechanics Q service, man-hours						Mechanics and overhead Q service, man-hours						Other maintenance and overhead in-storage maintenance, man-hours				In-storage maintenance at current level[a] overhead and labor, man-hours				In-storage maintenance at proposed level[a] overhead and labor, man-hours			
UPI	8[b,c]	12	20	25	37[d]	55[e]	8[b,c]	12	20	25	37[d]	55[e]	Whs mnt[f]	OH[f]	Arty & Sig	OH Dr	8[c]	20	37	55[e]	8[c]	20	37	55[e]
0.35	552	746	1143	—	—	—	754	1019	1561	—	—	—	—	—	—	—	2611	—	4580	—	—	—	—	—
0.37	527[g]	705	1081	—	—	—	719[g]	963	1476	—	—	—	—	—	—	—	2470	—	—	—	3378	—	—	—
0.44	439	593	920[h]	—	—	—	599	810	1256[i,h]	—	—	—	—	—	—	—	2077	2718	—	—	—	3484	—	—
0.50	386	527[g]	800	972	—	—	527	719[g]	1092	1327	—	—	—	—	—	—	1828	2392	—	—	—	—	—	—
0.53	364	492	755	920[h]	—	—	497	672	1031	1256[i,h]	—	—	—	—	—	—	—	2257	—	—	2358	—	—	—
0.62	311	421	645	784	—	—	425	575	881	1070	—	—	—	—	—	—	1474	1929	2575	—	2016	—	3131	3753
0.67	288	390	597	725	—	—	393	532	815	990	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.72	268	363	556	675	969	—	366	496	759	922	1323	—	Proposed allocation[j]				—	—	—	—	—	2129	—	—
0.76	254	343	527[g]	639	920[h]	1292	347	468	719[g]	872	1256[i,h]	1764	751	274	273[k]	—	1203	1574	2109	2618	1645	2017	2554	3062
0.80	241	326	500	608	873	1228	329	445	683	830	1192	1677	Current allocation[j]				—	1495	2004	—	1563	—	—	—
0.83	233	314	482	586	841	1183	318	429	658	800	1148	1615	403	147	233[k]	127 349[l]	1101	1441	1931	2398	1506	1847	2389	2804
0.92	210	284	435	527[g]	759	1068	287	388	594	719[g]	1036	1458	—	—	—	—	—	—	—	—	—	—	2110	—
1.00	193	261	400	486	698	982	264	356	546	664	953	1341	—	—	—	—	914	1196	1603	1990	1250	1533	1941	2327
													Required additional mechanic spaces at 0.76				—	—	81 378	218 750	—	33 0	177 378	313 750
													Excess overhead and mechanic spaces at 0.76				32 288	0 15	—	—	66 288	0 15	—	—
													Excess overhead, labor and driver spaces at 0.76				127 349	61 349	0 349	0 349	—	—	—	—
													Add surveillance crew[m]				100	100	100	100	100	100	100	100
													Net excess spaces				696	325	—	—	254	—	—	—
													Net required spaces				—	—	210	719	—	118	655	1103

[a]Eliminating 475 driver and driver-overhead spaces.

[b]Average Q inspection—LTVIII wheeled vehicles. Q man-hours maintenance per vehicle per half year—8.2 used as Q time for all vehicles.

[c]Does not include road test.

[d]Proposed average inspection, traced 77 man-hours, wheeled 49 man-hours—includes 2 man-hours preservation per WVE plus ROAD test.

Computation of WVE: 1747 tracked × 3.5 WVE 6120
6305 wheeled × 1.5 WVE 9460
4400 trailers × 0.2 WVE 880
Total 16460 WVE.

Computation of average Q service: 1747 tracked × 77 man-hours 134519
6305 wheeled × 49 man-hours 308945
8052 443464
443464 ÷ 8052 = 55 man-hours per service.

[e]Includes 8-hr road test.

[f]Extrapolated from proposed in-storage maintenance program.

[g]Current approximate allocation

[h]Maintenance group estimates of manpower requirement.

[i]Overhead taken as 0.3653.

[j]Proposed allocation taken at 0.76 level—current allocation taken at 0.83 level. Results normalized at 0.76.

[k]233 currently assigned—workload to increase 17 percent, therefore 233 × 1.17 = 273. Level taken at 0.76

[l]For information only—not to be included in totals—weekly patrol substituted—current allocation 349 drivers plus 127 overhead.

[m]In-place weekly patrol inspection of vehicles.

CONFIDENTIAL

TABLE 11

Approximate Civilian Manning Required for Various Levels of Maintenance after ROAD Conversion

UPI	Requirement, man-hours																					
	Mechanics										Warehouse maintenance		Overhead		Artillery and signal	In-storage maintenance						
	Q service					Overhead added										At current level					At proposed level	
	8	12	20	37	55	8	12	20	37	55	High-level	Low-level	High-level	Low-level		8	12	20	37	55	8	12	20	37	55
0.76	183	247	379	662	930	250	337	517	904	1270	633	339	230	124	214	928	1014	1195	1580	1947	1328	1414	1595	1980	2349
0.83	168	226	347	606	852	229	309	474	827	1163	580	310	211	113	196	849	929	1094	1447	1784	1216	1295	1460	1813	2151
0.89	156	211	324	565	794	213	288	442	771	1085	541	290	197	106	183	792	867	1021	1350	1664	1134	1209	1363	1692	2006
1.00	135	188	288	503	707	190	256	393	686	966	481	258	175	94	163	705	771	908	1201	1481	1009	1075	1212	1505	1785
															Add surveillance crew	72	72	72	72	72	72	72	72	72	72

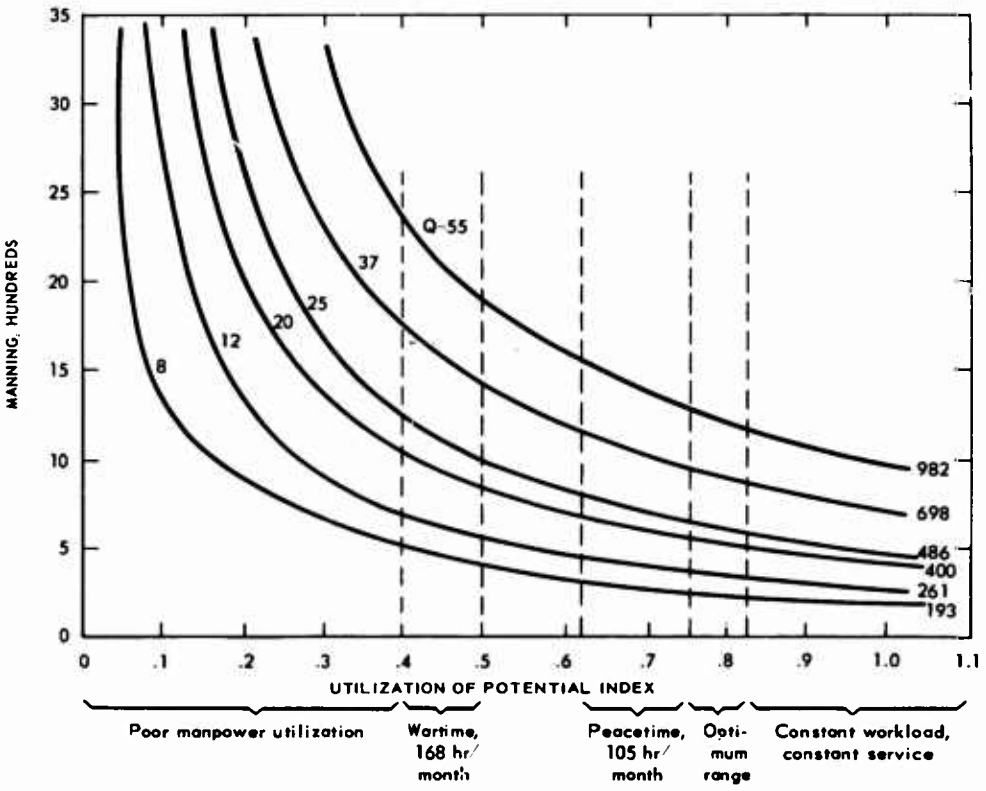


Fig. 1—Military Manning Requirements, Mechanics

Mechanic Man-Hours per WVE

Q level, man-hours	WVE (including preservation), man-hours
8.2	7.4
12.0	10.0
20.0	15.3
25.0	18.6
37.0	26.7
40.8	29.2
55.0	37.6

Sample computation: $\frac{16460 \text{ WVE} \times 26.7}{630 \text{ man-hours}/\frac{1}{2} \text{ year (at 105/month)}}$ 698 men

The superintendent was queried about the difficulties that might be expected in activating a similar unit for in-storage maintenance of prepositioned vehicles. He estimated three men for 50 vehicles as a rule of thumb. [The maintenance group reports (19 May 64) that 2 mechanics are being used for 50 vehicles.] This includes a technical inspection of 10 percent of stored vehicles per month. He stressed the fact that the key personnel of such a unit must be selected with care, and he advocated the use of Germans. He did not believe recruiting would be very difficult; but the larger the number to be recruited, the longer it will take to round the unit out. This suggests that the acceptable transition would be to phase out the military as the civilians are phased in.

For the most part the support furnished the CLG is very similar to that furnished regular units of the US Army. The allowances for food, clothing, and quarters are about the same. All parts, tools, automotive supplies, etc., are furnished by the Army.

Since the pay is fairly comparable, the principal discernible differences between a regular unit and the CLG are in the levels of skills and in the productive-time available. No attempt was made to compare quality of output, but because the CLG man is a career man with an average of 10 or more years' experience and unreserved praise has been accorded CLGs by many officers who are familiar with their work, the evidence is clear that the quality of this work compares more than favorably with that of a similar regular unit.

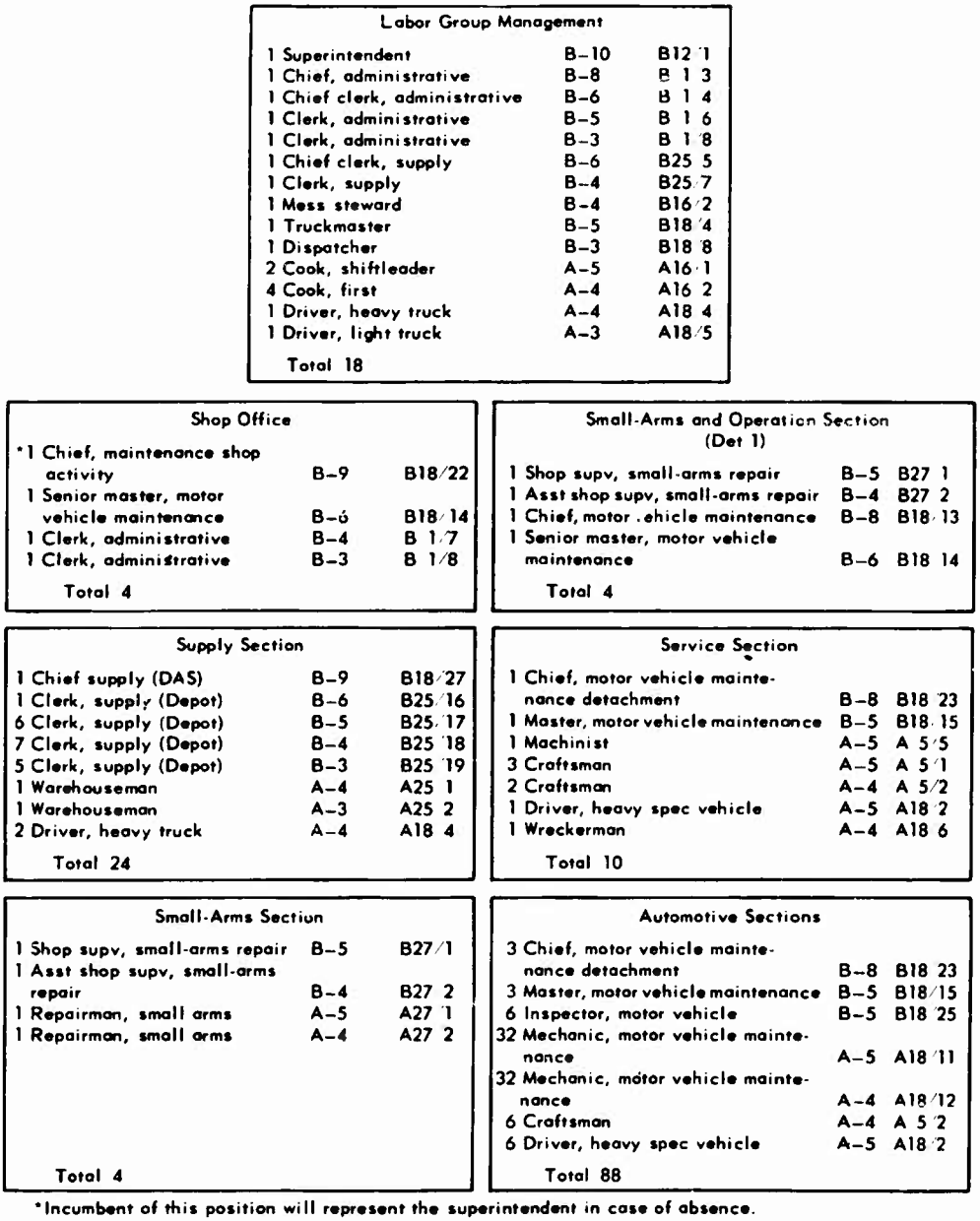
The one CLG investigated has an authorized strength of 152 but is consistently manned at a strength of 149, of which nine (including overhead) are assigned to small-arms repair. The productive time of only the automotive personnel will be considered in the calculation of the UPI (98 direct plus 42 overhead).

The working day for these men is 10 hr (with 1 hr for lunch), 5 days/week, or a nominal 2600 hr/year per man. From this nonproductive time is deducted as follows:

Lunch	238 hr
Leave	220
Sick call	16
Military duty	134
Administrative time and holidays	260
Total	868 hr

The productive-time availability per man in the CLG is thus 1732 hr/year, or 40 percent more than that obtained from the peacetime soldier. The CLG has an estimated vehicular workload of 3100/4 = 775 WVE per month.[27] (The workload of this unit is the field-maintenance support of 2667 wheeled vehicles and 1631 trailers, or approximately 3100 vehicle equivalents.) Although SR 310-30-15[27] is not quite clear on this point, it is assumed that the figure given of 25 man-hours/field-maintenance repair also includes overhead (Ref 32, p 474). Thus 775 WVE is equivalent to a demand of 1937 man-hours. On this basis this CLG unit has a peacetime UPI of 0.89, an index so high as to indicate highly efficient manpower utilization. The unit discontinues shortly after D-day, so it has no wartime mission and no wartime index.

Since the use of a CLG team for permanent maintenance seems to merit serious consideration, examination of the gold outflow that results is appropriate.



*Incumbent of this position will represent the superintendent in case of absence.

Fig. 2—Organization Chart, 8902d Civilian Labor Group

REF.: USAREUR Cir 600-438 (31 Oct 61)

LABOR SERVICE PERSONNEL UTILIZATION AND STATUS REPORT
(USAREUR Circular 600-438)

REPORTS CONTROL SYMBOL: AEAL-1(R1)

1. REPORTING UNIT	2. SUPERVISION UNIT	3. DATE
902 CLC (ORD DAS CEN)	12th Lbr Supv Dis	28 Feb 63
4. LOCATION	**5. ADDRESS**	**6. COMMAND TO WHICH ASSIGNED**
Esslingen/ Neckar	APO 46, US Forces	Seventh Army

7. ASSIGNED STRENGTH - GRADE BREAKDOWN

GRADE	STEP 1	2	3	4	5	TOTAL AUTH	TOTAL ASG
a	b	c	d	e	f	g	h
B - 11							
B - 10				1		1	1
B - 9				2		2	2
B - 8			2	4		6	6
B - 7							
B - 6			1	1	3	5	5
B - 5		1	2	13	4	20	20
B - 4	1	2	1	7	1	12	12
B - 3	2	2		2	2	8	8
B - 2							
B - 1							
B SUBTOTAL	3	5	6	30	10	54	54
A - 6							
A - 5	7	6	3	27		16	43
A - 4	30	7	4	7		50	48
A - 3	3	1				2	4
A - 2							
A - 1							
A SUBTOTAL	40	14	7	34		98	95
TOTAL	43	19	13	64	10	152	149

8. NATIONALITY

NATIONALITY	MARRIED	SINGLE	TOTAL
i	j	k	l
ALBANIAN			
BULGARIAN			
CZECHOSLOVAK			
ESTONIAN			
GERMAN	58	90	148
HUNGARIAN			
LATVIAN			
LITHUANIAN			
POLISH	1		1
ROMANIAN			
RUSSIAN			
UKRAINIAN			
YUGOSLAV			
TOTAL	59	90	149

9. PAY DATA

A - 205,63
B - 180.00
C - 452,80
F - 2,350.00
(Total costs: 100,216.39)

10. NO. NON-PAY STATUS: 2

11. MANDAYS LOST

a. SICKNESS	b. OTHER
192	108

12. UTILIZATION

This unit is supporting:
67 units, 2,667 wheel vehicles, 1, 631 trailers, 11,829 small arms

13. REMARKS

Explanation for subitem 9-F
285.00 foremans supplement (5)
12.00 travel discharge
1,156.00 standby duty
895.00 Article 2, TA#6
DM 2.350.00

Explanation for subitem 11b
44 men 105 days Ord lv
2 men 3 days AWL
Total Losses : 108 days

AGL (1) 6-61-50M-8240

Fig. 3—Sample of Labor Service Personnel Utilization and Status Report, Form AE 471

14. PERSONNEL ACTIONS

NAME	LSBN	DATE	NATURE OF ACTION
GAINS			
A-4/1 STEINL, Franz	182 191	23 Feb 63	inst
LOSSES			
A-3/1 BIENICK, Dietmar	182 172	01 Feb 63	transf to 8043 CLG
A-4/1 PULKO, Josef	169 276	28 Feb 63	separated
A-4/1 RAMEL, Dieter	182 173	15 Feb 63	separated
NONPAY STATUS			
A-5/2 MEISSNER, Gerhard	169 198	01 Jul 62	Mil Svc Ger Army, 18 month
A-4/2 PYSNY, Hans	169 180	30 Sep 61	Mil Svc Ger Army, 18 month

15. TYPED NAME AND GRADE OF UNIT SUPERVISOR	16. SIGNATURE	17. TP. NO.

Fig. 3—Continued

Gold Outflow Entailed. The CLG-DAS organization chart is shown in Fig. 2 and a typical monthly status report, Form AE 471, is reproduced in Fig. 3. Pay rates, in deutsche mark, are shown in Table 12. From these it has been determined that the average monthly take-home pay is $169 per man. Other benefits accruing are in kind and can be ignored since they do not appear as gold outflow. Installation costs, technical supply, etc., remain unchanged.

TABLE 12

Civilian Labor Group Pay Rates

Personnel category	Salary, deutsche marks[a]				
	Step 1	Step 2	Step 3	Step 4	Step 5
Group A					
1	435	450	465	485	—
2	460	475	490	510	—
3	490	505	525	550	—
4	515	530	550	570	—
5	550	565	585	610	—
6	590	610	635	660	—
Group B					
1	444	456	466	479	498
2	470	489	506	530	551
3	529	552	578	605	630
4	583	605	631	656	683
5	648	673	699	722	750
6	742	766	791	816	849
7	830	855	888	922	959
8	952	999	1046	1094	1138
9	1084	1132	1194	1257	1307
10	1211	1286	1362	1439	1497
11	1337	1413	1490	1570	1632

[a] Approximately 4 DM dollar.

The last Seventh Army G1 informal survey (January and March 1962) of the gold outflow shows that the average monthly take-home pay of military personnel was $164 per man, of which $36 was spent on the economy. The UPI for the CLG can be held consistently at 0.89. The military UPI may vary somewhat, most probably between 0.62 and 0.76.

Table 13 assembles the above values into a comparison of net cost and net gold outflow for various combinations under several levels of maintenance effort. The low level is defined at 8.2 man-hours/automotive vehicle per 6 months. The high level is defined as 55 man-hours/automotive vehicle.

Using the CLG operating at 0.89 and a comparable military unit at 0.62 at the low level of maintenance, the net saving is $112,000 per month but the net increase in gold outflow is $89,000. Similarly at the high level the net saving would be $281,000 per month and the net increase in gold outflow, $212,000.

The foregoing concerns only the custodial unit itself with only second-echelon repair capability. Three ordnance third-echelon units now support the

TABLE 13

Cost and Gold Flow by Maintenance Level

(Monthly costs, extreme values)

Maintenance level, man-hours per inspection	Military				CLG				Estimated result of CLG use	
	UPI	Strength	Pay,[a] dollars	Gold flow, dollars	UPI	Strength	Pay,[b] dollars	Gold flow, dollars	Saving, dollars	Net gold-flow increase, dollars
Low, 8.2	0.76	1303	213,692	46,908	0.89	864	146,016	146,016	67,676	99,108
	0.62	1574	258,136	56,664	0.89	864	146,016	146,016	112,120	89,352
High, 55	0.76	3162	518,568	113,832	0.89	2078	351,182	351,182	167,386	237,350
	0.62	3853	631,892	138,708	0.89	2078	351,182	351,182	280,710	212,474
20	0.62	2029	332,756	73,044	0.89	1093	184,717	184,717	148,039	111,673
37	0.62	2675	438,700	96,300	0.89	1422	240,318	240,318	198,382	144,018

[a] Take-home, $164; $36 to gold flow.

[b] Take-home, $169; $169 to gold flow.

custodial units. If CLG is utilized the custodial TD could well include third-echelon capability. This would increase the size of the unit but release the ordnance companies for other duties. A reasonably accurate TD to include this third-echelon capability would not be difficult to draft. The cost of the operation would be much smaller than military operation, as can be inferred, but the net gold outflow would necessarily increase by something over $100/ month per additional civilian required.

To say the least, the use of a CLG for custodial maintenance should be studied further.

Effect of Program Variability

Preparation for BIG LIFT has shown that the exercise program, under present conditions at least, gives no assurance of subsequent reliability (see subsection "Reliability"). The alternative, made clear by the data at hand, is a program of regular inspections and repair. The fogging procedure proposed by the P&P team was expected to eliminate exercise of wheeled vehicles, and a procedure to preserve tracked vehicles without exercise was to be devised by the P&P team. Fogging is allegedly good for a period of 6 months; thus all computations of manning for an organization that combines preservation with periodic inspection were based on this 6-month cycle.

With the introduction of fogging as part of the S service, the exercise program was discontinued after BIG LIFT.

Morale*

The problem of morale was not studied in this project because of the early decision to concentrate on problems of seemingly greater importance. However, this factor was observed during the course of the investigation. The following comments are based purely on this cursory observation:

It was fairly obvious that a large proportion of the men were below the average usually encountered. Rotation is nearing for many, and in the ordinary course of events the units will approach average as new assignments are made. Probably this low level will correct itself in time.

The chief complaint was lack of opportunity for promotion. The men usually volunteered the information that no promotions had been made in the maintenance groups during their tour. No check was made of the validity of this or any other complaint; comment on this is made merely to report the attitude of those men with whom the study team came into contact.

Low morale may be caused by several other possible factors. The custodial mission ceases after staging and issue and the men are therefore uncertain of their future. For a time the general expectation was that they would be absorbed into the incoming unit, but later it was accepted that no

*Most of the deficiencies discussed in this section appear to have been corrected prior to July 1964.

detailed plan existed for their disposition, and they would eventually go to a replacement unit.* Consequently there was very little pride in the outfit.

Working conditions are improving generally, but for a time field conditions prevailed and the men had difficulty reconciling this with the supposedly permanent type of operation expected under the prepositioning concept. Most of the work has to be conducted in the open; in winter the cold slows the operation, and in the spring the mud and casual water frequently hinder operations.

The men were not in sympathy with the exercise program and seemed to be unanimous in their belief that it made no sense. Observation of the exercise procedure in most instances disclosed a token performance and, in one instance at least, downright carelessness.

Conditions appeared to be much better in the officer class. For the most part command and staff were proud of the systems they had been permitted to introduce and the work they were able to do though restricted by the instructions from higher headquarters.

The change in the maintenance procedure that eliminates exercise and concentrates on preservation and periodic inspections by mechanics should do much to alleviate the maintenance problem for the officer personnel.

Since no concentrated study was made of this problem area, no formal recommendations can be made, but it is suggested that morale will improve as facilities are improved, TAs are approved and tools issued, the rotation process effects changes, maintenance procedures are finalized, and a detailed plan is evolved for disposition of the men after their mission has been accomplished.

MAINTENANCE PROCEDURES

Original

The first maintenance group, composed of maintenance personnel from the earmarked user divisions, was to receive the equipment and prepare it

* Para 6, Hq, Seventh Army LOI 12 Aug 63[33] states:

(C) Personnel: a. Personnel assigned to the Maintenance Groups for the accomplishment of missions and responsibilities related to prepositioned equipment will continue to perform their duties as directed by Commanding General, Seventh Army Support Command, until such time as this mission is accomplished or Seventh Army is relieved of this task.

b. When the mission is accomplished and personnel of the Maintenance Groups are no longer required in their initial role, Commanding General, Seventh Army Support Command will recommend and Commanding General, Seventh Army will direct their assignment based on the existing situation. For planning purposes, the following priority of assignment is assumed:

(1) Fill any critical personnel shortages which may exist in incoming units whose equipment is being maintained by the Maintenance Groups.

(2) Use as replacements as determined by Commanding General, Seventh Army.

The paragraph cited above was revised in May 1964 by the action staff section (G4) to replace "Commanding General, Seventh Army Support Command" with "Commanding Officer, Seventh Army Augmentation Readiness Group."

for storage by means of a Q inspection. Few records of this operation remain, but evidence is available that the reception of the equipment was a huge task that left little time for adequate preparation of the vehicles for storage.

When the present TD units relieved the L&M detachments an LOI[3] from Hq Seventh Army designated the custodial-forces maintenance procedure that was later incorporated in the SOP of the IMG from the AMG.[7,8] The major provision of this procedure was biweekly exercise of the powered vehicles. No vehicle was to be given a further Q inspection unless it had been in operation.

The preparation necessary for LT exercises indicated that the initial Q service and subsequent exercise did not keep the vehicles in RFI status (under the IROAN concept, Code 1). The reliability of the vehicle for the prescribed period, 90 days after issue, is discussed in more detail in the "Reliability" subsection.

In all units universal dissatisfaction was found with the prescribed exercise program and the condition of the vehicles resulting from the unsatisfactory initial preparation. The AMG road-marched about 250 vehicles for 100 miles, complying with the instructions for operation before performing the Q inspection deemed necessary to bring the vehicles to an RFI status. In preparation for BIG LIFT, road marches were resumed on a much larger scale, but, after about 700 vehicles had been marched, this procedure was discontinued because of the grave risk of crippling the vehicles by moving directly from the park without second-echelon inspection.

Current

The procedure in preparation for BIG LIFT, in effect at this writing, is to perform an S check on all vehicles, give them an extended road test, complete a technical inspection (TI), and correct all remaining deficiencies. Only then is the vehicle considered RFI (Code 1). (This procedure is substantially that put into effect following BIG LIFT, except that the road test has been shortened or deleted and preservation processing has been added.)

Because of the increase in vehicles in the ROAD armored division and the field maintenance required on most of the vehicles in preparation for BIG LIFT, the IMG has been called on to furnish all additional equipment to bring the AMG materiel up to TOE level and the AMG has been augmented by approximately 1000 mechanics and other skills to inspect and service all materiel. If it is kept in mind that the AMG will have had 4 months' notice of BIG LIFT, the discussion of the condition of the equipment (see the section "Effect of 2-Week Exercise Periods on Operational Readiness") may be understood better. The reliability of the equipment was so seriously in doubt that this rather sizable maintenance effort was deemed necessary as insurance against complete failure of the exercise.

Proposed

Semiannual inspections (see Fig. 4) have been proposed in conjunction with a preservation process that includes fogging. These inspections and servicing are to be phased over time. Maintenance of a 6-month cycle requires that 61 automotive vehicles, not including trailers, be serviced per working day (8012 vehicles, 131 working days/half year). A surveillance

patrol on the parks will tend to increase the continuing workload somewhat by turning in for repair the deficiencies, discovered during patrol, that cannot be repaired by the surveillance personnel. On the other hand the workload in preparation for issue will be diminished.

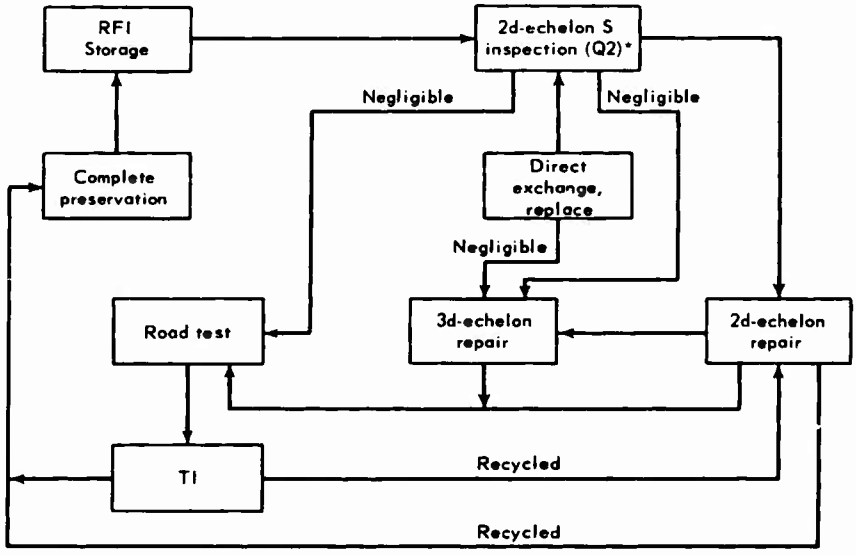


Fig. 4—Simplified Model of Current and Proposed Semiannual Maintenance Cycle

*Includes some preservation.

Maintenance Standards. These have not been developed for the achievement of the desired degree of reliability. The maintenance groups have estimated that 55 man-hours/automotive vehicle (not including trailers) will be required to keep the specified number and types of vehicles in top shape for the 6-month cycle.* The proposed schedule is shown in Table 14. No data sufficient to estimate the degree of reliability to be ensured by this amount of maintenance exist at this time.

The records of several active units have been studied, with only partial success, to obtain some standard whereby prepositioned equipment can be judged. No reason is apparent for forcing the prepositioned materiel to a standard higher than the theater average, particularly in view of the manpower costs involved, if, with acceptance of the criterion of Ref 5, p 74, a 90-day level of major components is also prepositioned.

To obtain a set of standards some statistical control must be exerted on the activity records of selected units over a significant period of time. This

*The ARG comments,[34] 19 May 64, that "The figure of 55 man-hours is desirable, but a somewhat lesser figure of about 42 man-hours should meet minimum requirements. The extensive road test, although desirable, is not considered essential to good maintenance.

can be done in the theater but it will require several months. The study of the vehicles of the aggressor force in BIG LIFT offers an opportunity for rapidly obtaining the desired standards. The performance of the prepositioned equipment during BIG LIFT can then be compared relatively easily with performance of other equipment. Data from LT have given a sample of performance after a recorded low service. Data from the early marches of the AMG give a sample of performance without any service. Finally the data from BIG LIFT will furnish an estimate of performance after the longer service.

TABLE 14

Maintenance-Group Estimates of Man-Hours per Half Year Required To Achieve Maximum Reliability

Service	Time, man-hours		
	Wheeled vehicles	Tracked vehicles	Trailers
Inspection	2	1	½
Service, including preservation	32	50	3
Mechanical road test	1	5	0
Repair	8	12	½
Inspection	1	2	½
Fogging	2	1	0
Total	49	77	4½

The above applies to vehicles only. No records are available on most of the other prepositioned equipment; but, again, BIG LIFT offers an opportunity to obtain standards and performance for representative high-density items. These should be sufficient to set a level of maintenance that would ensure comparable performance.

Storage. Controlled-humidity warehousing has been accepted for the long-range plan. Large warehouses will contain all class I, II, and IV materiel (with a few exceptions). The relative humidity in the warehouse will be kept constant by means of external pumps. The cost of these warehouses will presumably be offset by the reduction in maintenance effort, although it is possible that bomb-resistant construction may be available for this purpose. Measurement or prediction of the efficacy of this procedure and investigation of existing resources are considered beyond the scope of this study.

Support by Higher Echelons

Originally all prepositioned equipment was satellited on the nearest existing third-echelon shops for support. Repair of prepositioned equipment was a secondary mission, and the backlog constantly grew larger. The modification work order (MWO) workload in third echelon was significantly high, and use of a priority-of-work system was necessary.

In the spring of 1963 two ordnance general service companies, one direct-support company, and a signal platoon were assigned specifically to support of

the prepositioned equipment. Evaluation of this support situation was impractical because of the abnormal maintenance requirements in preparation for BIG LIFT. If the semiannual inspection procedure is approved the requirement for this support should remain about the same, since the condition presumably will not be changed materially by the passage of time.

ISSUE AND TURN-IN

Issue and Use

Procedures for the reception, issue, and staging of an incoming unit[11] during the mating process, and for turn-in and return to storage,[12] are outlined in App A, "Property Accountability" section. Probably because of the comparatively small amount of equipment used and the long periods of advance notice, LT showed little deviation from these procedures. Furthermore, the same staging area has been used each time, and staging has become routine. Prior to BIG LIFT the staging areas for all the equipment had been selected but not used except for LT; thus LT has been the only means for evaluating this part of the custodial mission.

With the advent of BIG LIFT and the preparations required for it, it was realized that even with 4 months' notice the AMG alone could not possibly get the armored equipment into the proper condition in time. The necessary augmentation for this purpose may well exceed 100 percent of the permanent maintenance group. (The actual mechanic augmentation was reported as 126 percent.) It is much too early to evaluate any segment of this preparatory effort, but it may prove very fruitful during BIG LIFT to examine these examples of the several problem areas that have emerged: (a) sustained maintenance effort required to ensure a constant acceptable state of operational readiness; (b) augmentation required during the critical 14-day period and the planning required to designate and move this augmentation to the proper locations at the proper time; (c) replacement materiel to be prepositioned to ensure the desired degree of reliability during the 90 days required to establish normal support with respect to the amount of maintenance effort furnished by the custodial groups (cost-effectiveness study indicated); and (d) development of a set of standards of performance and determination of amount of risk involved in tolerance limitations about that set.

Turn-in

Turn-in of equipment is entirely a peacetime operation. In the maintenance group SOP[12] this aspect is treated as "operation and preparation for re-storage after such operation. For such small exercises as LT the custodial unit has the capability for this task. Under BIG LIFT, augmentation by maintenance personnel from the using unit will be required for the period of restorage preparation. The evaluation of this operation has no bearing on the wartime mission of the custodial units.

EFFECT OF BI-WEEKLY 10-MIN EXERCISE PERIODS ON OPERATIONAL READINESS

With the data available from a sample of 20 exercise periods (4 Sep 62–7 Jun 63) for 107 vehicles, an estimate was made of the operational readiness of these vehicles, i.e., their capability of starting up and driving past a designated starting point at a given point in time.

Of the 699 deficiencies reported during these 40 weeks (2 weeks between exercise periods), 13 were cancelled, 54 were MWO applications, 4 required fabrication, 94 were recorded repaired, 145 were unrecorded repaired, 317 minor deficiencies were uncorrected and requisitions had been forwarded, 33 were uncorrected but were continued in service unrepaired, 39 (31 of which had been repaired) had been evacuated, and—at the end of the 40 weeks—only 8 were on deadline. Therefore 99/107 = 93.5 percent apparently operationally ready.* The great majority of the deficiencies discovered were minor in nature; the possible low efficiency of the exercise procedure in uncovering major deficiencies casts some doubt on the validity of this readiness estimate.

TABLE 15

Distribution of 699 Deficiencies Discovered during Exercise Periods

(107 vehicles)

Exercise periods uncovering deficiencies	Deficiencies per vehicle	Vehicles deadlined
166	1	11
90	2	3
13	3	1
22	4	2
9	5	0
6	6	0
2	7	0
1	8	0
1	9	0

An interesting estimation of the condition of the vehicles of the 107-vehicle sample is given in Table 15. In 40 weeks there were 2096 exercise periods; deficiencies, distributed as shown in the table, were found in 343 periods. No deficiencies were found in 1762 periods.

*An opportunity to check this value was offered when the AMG road-marched several hundred vehicles, apparently selected at random; 95.5 percent of the vehicles started up but 1.2 percent failed to leave the park, giving about 94.3 percent readiness, which agrees with the first estimate. The extensive preparation for BIG LIFT raised this value to more than 98 percent.

The distribution of deficiencies indicated that discovery was primarily a function of the care with which the inspection was made. The grouping of discoveries indicated some perturbations caused by holidays and cold weather, but the reasons for others can only be guessed. Discovery distribution is shown in Fig. 5.

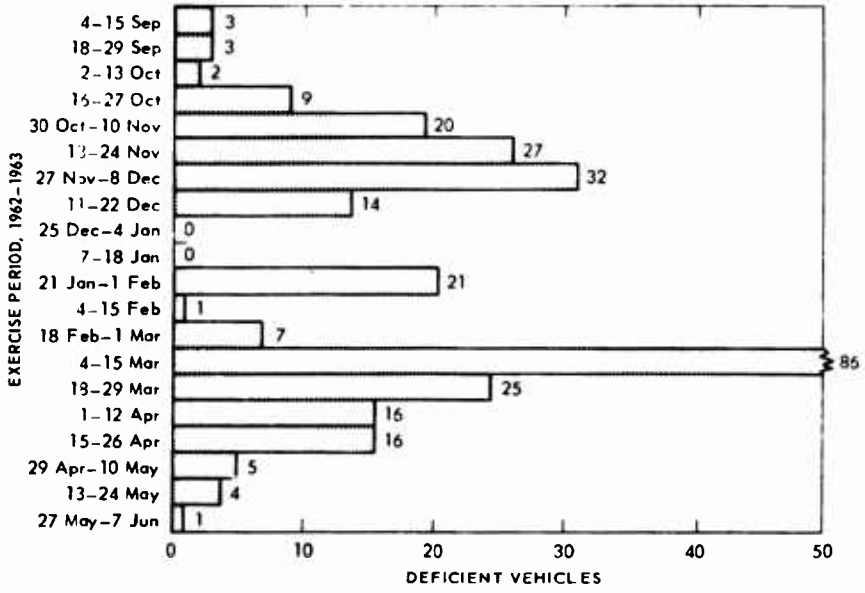


Fig. 5—Distribution of Deficient Vehicles by Exercise Period
107 vehicles, 40 weeks of exercise periods.

At first glance, Table 15 gives the impression that the vehicles were in fairly good condition. Actually the continued mounting of maintenance man-hours required for preparation for BIG LIFT becomes an increasingly stronger indictment of the efficiency of the exercise program or of the manner in which it was conducted. (Maintenance man-hours per vehicle in preparation were close to 150 during the period 8 Jul–22 Oct 63.) Efficient surveillance procedures would probably have identified many of the deficiencies remaining undiscovered throughout the 40-week period. A model of the exercise program (see Fig. 6) shows the paths in the procedure by which deficiencies would easily escape detection.

ASSURANCE OF RAPID RESPONSE

Before examining the reliability of the materiel now prepositioned some aspects of the prepositioning concept itself must be examined.

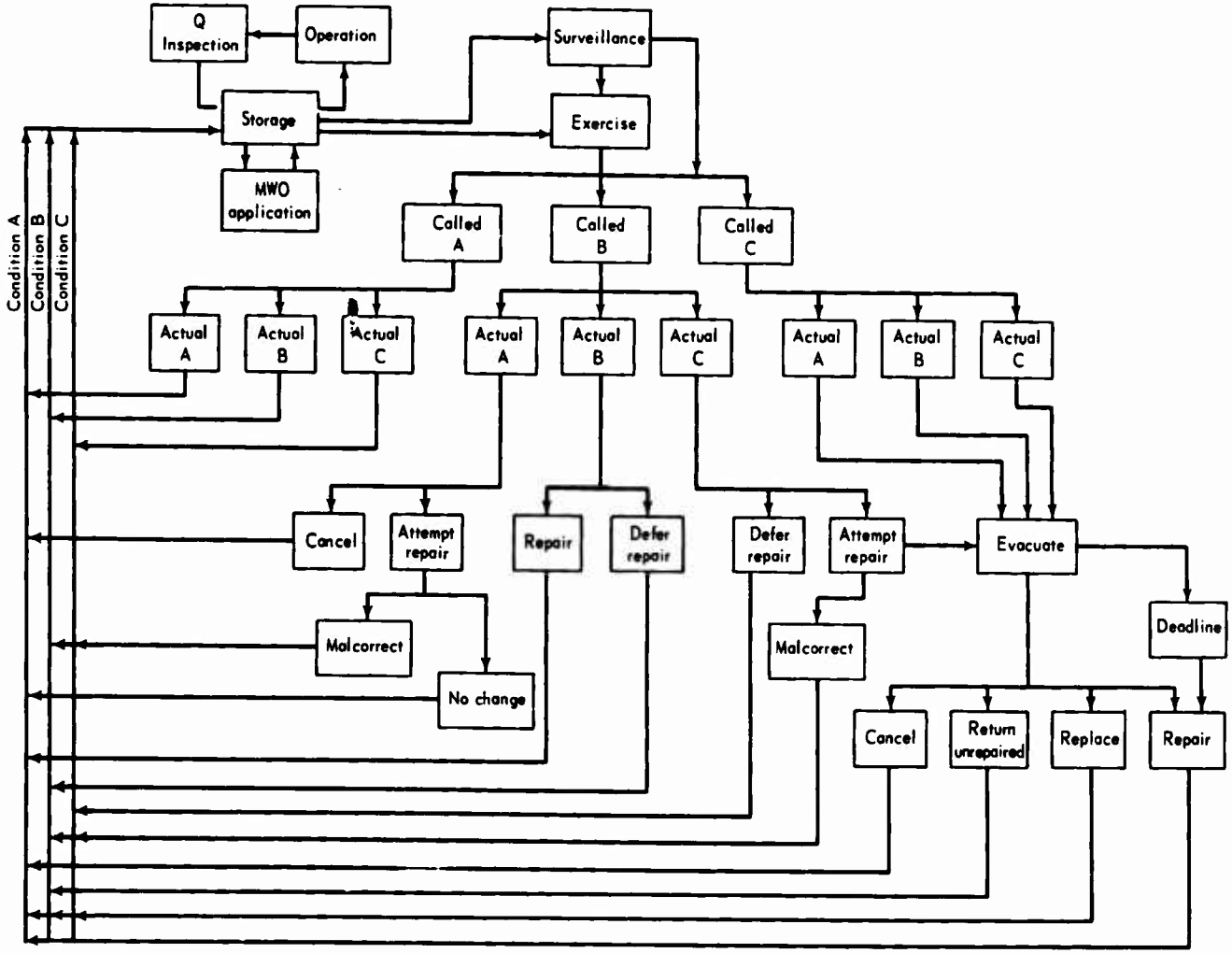


Fig. 6—Model of the Exercise Process

Condition A = serviceable, RFI; B = serviceable, requires minor repair, RFI; C = unserviceable, requires major repair.

The present logistic system in Europe is geared to support the existing military population. The introduction of two divisions into this system would create an enormous demand for logistic support (probably an increase of 25 to 40 percent) that would have to be met, at least in part, by the force in being.

The nondivisional elements of a division slice have a combined strength of approximately 30,000 men.[32] The support requirements can be inferred from the fact that more than 60,000 men normally are necessary to back up two divisions.

Apparently, then, the advantage achieved by the rapid response could be maintained at a consistently high level if equipment were prepositioned for both support and combat elements of the division slice.

Airlifting critical elements of the slice might be feasible or, when that capability is lacking, the support elements can be sea-transported with greater rapidity than if equipment had to be shipped also.

The keynote of prepositioning is rapid response; by extension of the concept to include the entire slice it follows logically that the advantage can be sustained. Of course the caveat is that there must be assurance that the reliability of the equipment will be maintained within acceptable limits, i.e., near the typical theater level, granted that this slice is operable and operating.

To preposition the materiel for the entire slice (roughly, over 200 percent more than is presently prepositioned) is beyond the resources of Seventh Army. The materiel and manpower allotted to original implementation severely taxed these resources as it was.

The establishment of prepositioning as a separate project to be funded, stocked, and operated separately but under administrative control of the area commander might well be a solution to this problem. The study of these aspects is considered beyond the scope of this project, but the advantage of having a rapid response that does not deteriorate with almost equal rapidity is intriguing enough to merit serious consideration of a companion study.

RELIABILITY

Resource Allocation

New equipment when issued will normally perform as well as or better than similar items that have been in use for some time. Used items may be made to approach a condition of newness by the expenditure of increasing lengths of time and quantities of replacement parts. The characteristic curve of any maintenance program directed toward maximum reliability takes a form similar to that shown in Fig. 7. When resources are inadequately allocated the equipment can be expected to have a lower level of reliability. Minor additions may make very little difference, as shown by the slope between A and B. Increasing allocations of resources may result in a much higher rate of return, until a point is reached at which the return begins to increase at a decreasing rate, as shown by the slope between C and D. At an optimum point, i.e., E, the return per unit expenditure on resources is maximum—i.e., maximum efficiency in the use of resources.

Logically, all other things being equal, the performance standard set for any item should take into consideration the location of this point of diminishing

returns. Obtaining the numerical coordinates of this point is quite difficult and, practically speaking, resources available to the Army in peacetime are seldom considered adequate in enough respects to do more than attempt to achieve this level, e.g., for a specific purpose, resources may be more than adequate but improperly used. The level about some point F is the usual compromise; maximum possible efficiency is obtained when all resource allocations are consistently at this same level if weighted according to their apparent military value.

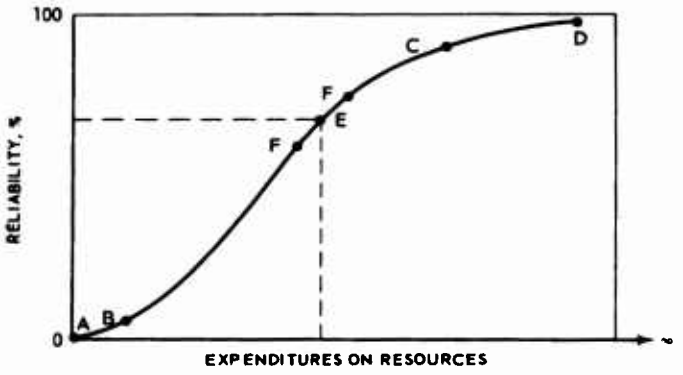


Fig. 7—Characteristic Curve of a Maintenance Program

The military value of the prepositioning concept is intuitively high, but it can hardly be considered of greater value than the concept of maintaining the highest possible level of combat effectiveness of the troop units already on the ground. The allocation of resources to achieve a performance standard for prepositioned equipment higher than that of Seventh Army active units must inevitably decrease the performance capability of these active units.

The problem then is to select performance criteria approximately equal to the theater level of performance used as a standard. The performance of the vehicles of several active units was studied for this purpose. Because of the recordkeeping system case histories could not be compiled in as complete a form as was desired for statistical evaluation. However, since the same condition was encountered in the records of prepositioned equipment, all biases were considered compensatory. Therefore the comparison with the derived standards can be made on a reasonably accurate basis.

For the purpose of this report, those data that were obtained from the active units have been used as the standard for comparison with the data obtained from the LT exercises (see the section "Utilization with Preparatory Maintenance"). The results stemming from so small a sample are not considered completely reliable, but they furnish considerable evidence concerning the condition of the equipment.

Effect of Preparatory Maintenance

Reliability, a function of deterioration or wearout (either because of in-storage time or operation) and maintenance after issue, is defined as the probability of continuous operation over a designated period of time or number of miles. Time will be used in the following discussion of prepositioned vehicles, although the argument also holds for mileage.

Vehicles may be expected to behave as shown in Fig. 8. The probability that the vehicle will run continuously until time t decreases as t increases. In other words, the reliability for the system is time dependent.

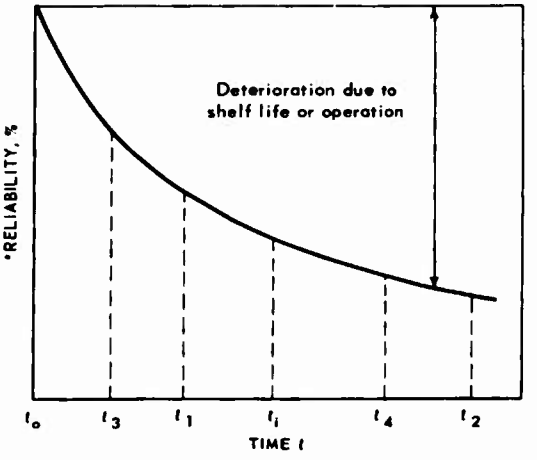


Fig. 8—Relation between Reliability and Time since Last Repair

Mission of length $T = t_4 - t_3$ or $t_2 - t_1$.

*Probability of continuing in operation until given time since last repair.

The probability of completing a mission of length T depends on the starting time relative to t_0, i.e., at maximum reliability. If the mission starts at time t_3, the probability of completing the mission is higher than if started at time t_1.

Generally advance notice of the next proposed issue of prepositioned vehicles (3 months for LT, 4 months for BIG LIFT) has been available, and the vehicles have been given maintenance preparatory to issue. Because of this maintenance all vehicles were considered to have been issued at time t_0.

In this study, for the purpose of measuring reliability, the 90 days (estimated time for the establishment of normal support) mentioned in Ref 5, Par 7, is considered the appropriate value for $t_1 - t_0$. The percentage of vehicles operating for 90 days without the requirement for major assembly replacement is called "90-day reliability."

One unresolved question is: How extensively and how often should this maintenance be accomplished? Obviously the amount of preparatory effort depends on the condition of the vehicles at the time of the alert. If the vehicles

have just been through extensive maintenance the preparatory effort should be less than if they have been standing untouched for a long period. (The maintenance group introduced a 6-month cycle—the S service—starting with the preparation BIG LIFT, 22 Jul 63.)

Whatever the magnitude of this preparatory maintenance, the performance of the vehicles for a limited period after issue should be predictable on the basis of the amount of preparation. Ordinarily in the quantity required for a division every vehicle, even new, cannot be expected to operate for 90 days without some major maintenance. Combat effectiveness with respect to mobility is a command evaluation and only the commander can decide whether the mission is successfully completed if 90 percent of the vehicles operate for 90 days or if only 50 percent of the starting vehicles are still in operation at that time. In other words, combat effectiveness of the vehicles of a unit from the viewpoint of mobility is closely aligned with the actual behavior of the vehicles as compared with their predicted behavior.

The mission of the unit designated to use the prepositioned equipment is essentially that of active units already in the field. Therefore in accordance with Ref 5 it would follow that prepositioned vehicles should be expected to have the same reliability during the 90-day period as active units. (This brings up the interesting corollary that if the prepositioned vehicles should have this reliability they must actually be RFI and have prepositioned ASL/AOSL of proper size.) A higher reliability is desired, but it may be an inefficient utilization of resources; a lower reliability may negate the whole reason for prepositioning equipment or introduce a measurable element of risk in selecting the lower level.

To obtain a control or standard for LT units, data from active battle groups were used. The standard affords a basis for comparing the effect of varying amounts of preparation on the reliability of the prepositioned vehicles.

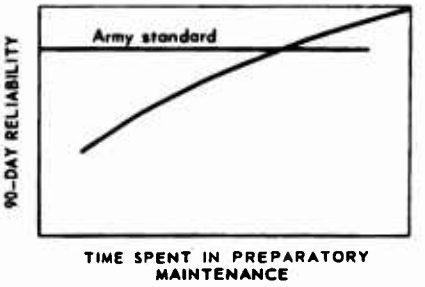


Fig. 9—Relation between 90-Day Reliability and Amount of Preparatory Maintenance

Assuming that all the prepositioned vehicles are at the same reliability level, i.e., a specific time since last extensive maintenance, Fig. 9 is an interpretation of how different degrees of preparatory maintenance "buy" reliability. At present, data exist for two points on the curve—no preparatory maintenance, and the preparatory effort for the several LTs. Presumably BIG LIFT will provide a third value, high-level preparation.

On the assumption that in time of emergency no time may be available for anything but token preparation, one objective of this study is to find the value for time since last extensive inspection and repair that will keep the vehicles in the constant state of readiness giving the maximum 90-day reliability consistent with the manpower and other resources available to Seventh Army.

UTILIZATION WITHOUT PREPARATORY MAINTENANCE

During the period 15–25 Jul 63, each of the maintenance detachments of the AMG road-marched a portion of its prepositioned vehicles. This march was called Short Thrust II. About 700 vehicles were driven directly off the park and their performance was recorded. Length of march for tracked vehicles was 25 to 28 miles and for wheeled vehicles, 100 to 107. Table 16 shows the type and number of vehicles marched by each maintenance unit.[35] It should

TABLE 16

Vehicles in 15–25 Jul 63 AMG Road March

Maintenance unit, detachment	Trucks				APC	Tank	Total
	¼-ton	¾-ton	2½-ton	5-ton			
1st	15	29	51	41	66	0	235
2d	72	6	35	23	12	33	181
3d	21	7	8	8	9	23	79
Artillery	18	28	7	11	2	0	66
Support	0	40	51	32	–	–	126
Total	159	110	158	115	89	56	687

TABLE 17

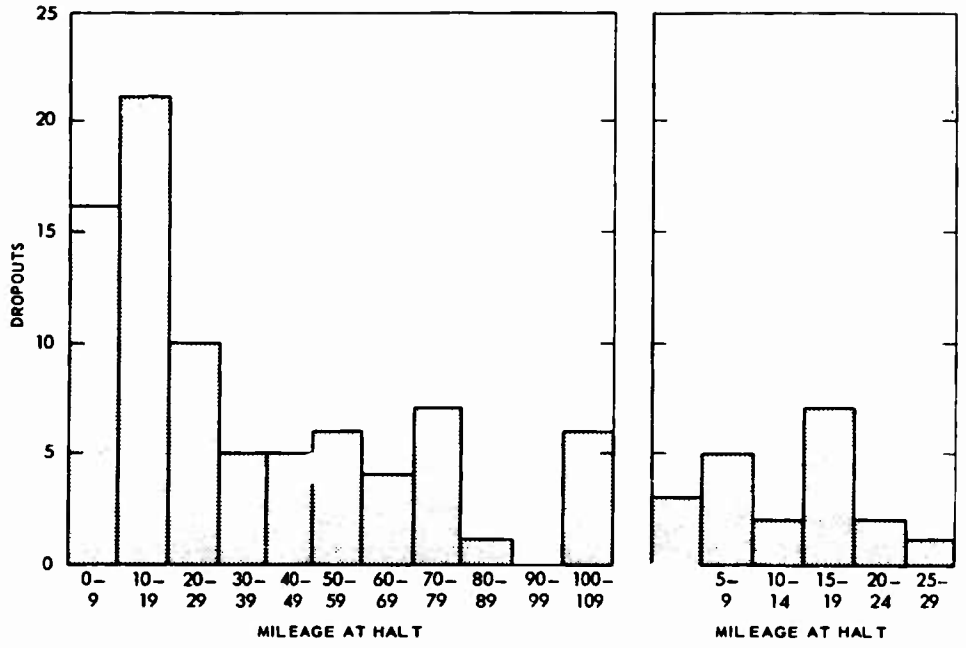
Vehicles Marched 15–25 Jul 63 as Percentage of Prepositioned AMG Vehicles

(687 vehicles, 21.2 percent of total vehicles)

Maintenance unit, detachment	Trucks				APC	Tank
	¼-ton	¾-ton	2½-ton	5-ton		
1st	29	41	32	33	32	0
2d	23	11	18	22	5	21
3d	17	19	11	13	13	13
Artillery	15	20	6	17	4	0
Support	0	48	12	46	–	–

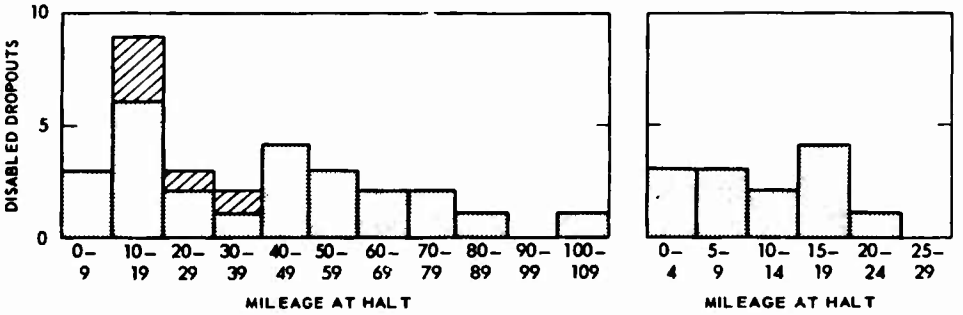
be stressed that these vehicles had presumably been stored since late 1961 and most had had no Q maintenance inspection for at least a year. This march and the march of the 249 vehicles reported previously (see "Data Sources") were the only cases of vehicles being started and driven off the park with no record of preparatory maintenance.

The vehicle density maintained by each detachment was given earlier (see first section); the percentage of each type of prepositioned AMG vehicles marched is shown in Table 17. These represented 21.2 percent of the total.



a. Wheeled vehicles, N = 81 b. Tracked vehicles, N = 20

Fig. 10—Mileage Distribution of Dropout Occurrence
All halts, AMG road march 15–25 Jul 63.



a. Wheeled vehicles, N = 29 b. Tracked vehicles, N = 13

Fig. 11—Mileage Distribution of Occurrence of Disabling Deficiencies
Vehicles unable to continue, AMG road march 15–25 Jul 63.

▨ Caused by lack of wheel cylinders.

Road-March Dropouts

The reporting form for Short Thrust II requested information on how far a vehicle traveled before coming to a maintenance halt, what the deficiency was, and whether the vehicle continued the march. Figures 10 and 11 show distributions of mileages at which the dropouts occurred—the former including all halts, the latter only the halts that forced the vehicle to discontinue the march and be towed in. As can be seen the wheeled vehicles experiencing failure showed a tendency to halt early in the march, although less than half the failures required the vehicle to be towed back to the park. Sixty-five percent of the tracked-vehicle halts were disabling.

It is interesting to note that 6 of the 29 disabling deficiencies on wheeled vehicles were caused by lack of replacement wheel cylinders for 2½-ton trucks. A total of 26 wheel cylinders were required during the march for these trucks and only 20 were available. The mileages at which these vehicles discontinued the march are indicated in Fig. 12. Most of the brake difficulties were experienced at the beginning of the march, 29 out of the total of 42 occurring in less than 30 miles.

On tracked vehicles the story was quite different. The power train—mainly the differential and transmission—accounted for more than half the deficiencies, primarily because of overheating. The electrical system accounted for another quarter of the trouble. Figures 12 and 13 show breakdowns of the deficiencies that occurred on the march. Figure 13 shows percentages of nondisabling deficiencies by type for both wheeled and tracked vehicles and Fig. 14 analyzes in the same manner the portion of deficiencies that provided disabling.

Vehicles Deadlined for Third Echelon

The road-march report did not give the entire story. On 25 Jul 63 the requirement was placed on the maintenance units to submit an Equipment Status and Deadline Report (DA Form 2406) to the AMG headquarters. Fully two-thirds to three-quarters of the vehicles entered on the form as deadlined for third echelon were participants in the road march and were deadlined between 15 and 25 Jul 63. Table 18 shows this number of vehicles by type.

Relating Table 18 to the total number of vehicles marched, Table 19 shows the percentages represented by vehicles evacuated to third echelon after the road march.

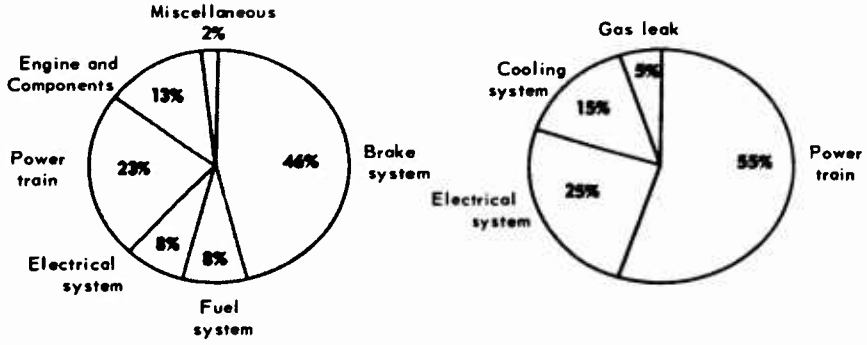
Vehicles Deadlined for Second Echelon

Table 20 gives the number of vehicles deadlined for second-echelon maintenance after the road marches. Some vehicles required both second- and third-echelon repairs. Table 21 provides a summary of vehicles requiring either level of repair; vehicles requiring both were counted only once.

Analysis of Data

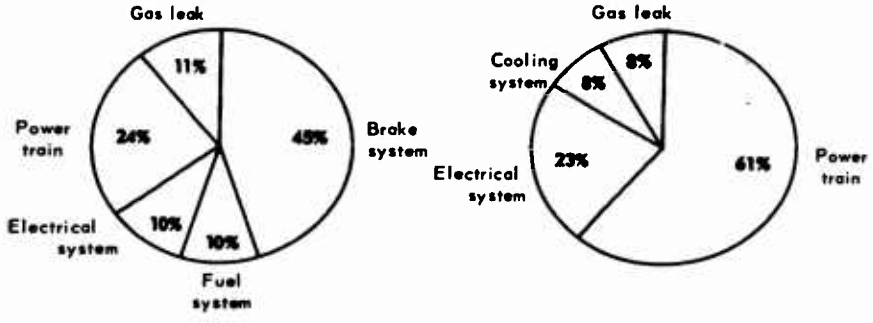
The percentage of vehicles deadlined for third echelon during or after the July road marches was 24 percent, as shown in Table 19. This figure may be somewhat high but establishes an upper bound.

Comparison of the march data (Table 16) and the deadlines (Table 21) for the Support Det shows an inconsistency. More vehicles were deadlined as a



a. Wheeled Vehicles, *N* 81 b. Tracked Vehicles, *N* 20

Fig. 12—Distribution by Type of Nondisabling Deficiency
Vehicles halted but able to continue, AMG
road march, 15–25 Jul 63; all halts.



a. Wheeled Vehicles, *N* 29 b. Tracked Vehicles, *N* 13

Fig. 13—Distribution by Type of Disabling Deficiency
Vehicles unable to continue, AMG
road march, 15–25 Jul 63

result of the march than were reported marched (e.g., ¼-tons, 2½-tons). Conceivably a number of nonstarts could have appeared on the deadline report but not on the march report, but this could not be confirmed. The possibility also exists that some vehicles participating in the march were not reported.

TABLE 18

AMG Vehicles Deadlined for Third Echelon during or after Road March, 15–25 Jul 63, by Type and Maintenance Unit

(Total,[a] 148 vehicles)

Battalion maintenance detachment[a]	Trucks				APC	Tank
	¼-ton	¾-ton	2½-ton	5-ton		
1st	1	–	13	1	6	–
2d	8	–	1	1	9	6
Artillery	16	1	1	–	–	–
Support[b]	1	23	48	9	–	–
Total	26	24	63	11	15	6

[a]Excludes 3d Det, which did not prepare Form 2406.

[b]It is possible that more vehicles were marched by Support Det than were indicated. No ¼-tons were reported marched, but at least 11 had second- or third-echelon deadlines between 15–25 July. Also, 63 2½-tons were reported deadlined although only 54 were reported marched. This could also be explained if nonstarts were included on Form DA 2406 but not on the march forms.

TABLE 19

Relation between AMG Vehicles Marched and Evacuations to Third Echelon after Road March, 15–25 Jul 63

Type	Reported marched[a]	Evacuated to third echelon	
		Number	Percent of vehicles marched
Truck			
¼-ton	135	26	19
¾-ton	103	24	23
2½-ton	150	63	43
5-ton	107	14	13
APC	80	15	19
Tank	33	6	18
Total	608	148	24

[a]Excludes 3d Det, for which no evacuation reports were available.

Assuming that the entire stock of prepositioned vehicles in the Support Det was marched, the percentage reported deadlined for third echelon drops to 18, a possible lower bound. (The Support Det had 207 vehicles, which were added to the 608 known marched for a maximum total march of 815 vehicles.) From this it can be concluded that of the vehicles in the original configuration

the percentage requiring third-echelon maintenance after marching up to 100 miles with no preparatory maintenance lies in the range 21 ± 3. However, improvement in equipment condition since July 1963 may have changed this value.

A comparison is possible here with the vehicles prepared for LTs III and VIII. Of 300 wheeled vehicles sampled, 27 required a third-echelon job order before issue. This work arose out of the Q inspection. The vehicles were not marched, so the mileage driven from the prepositioned site to the maintenance shop was comparatively low. These data indicate that 9 percent of the prepositioned vehicles would require third-echelon attention before they could be issued. These vehicles, which had gone on one LT and been in storage for less than 6 months, had also had a Q inspection after returning from the previous LT. In the process of this inspection, and as a result of the technical inspection (TI) after the turn-in of the LT vehicles to the IMG, 36 of 167 (22 percent) required third-echelon job orders. Two conclusions are possible: the 9 percent reflects the effects of open storage, or the Q or TI after turn-in was not what it should have been. Figure 14 shows the nature of the past LT job orders. Note the large proportion of seals—even after 6 months' operation.

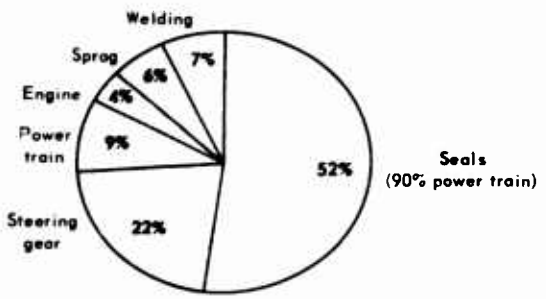


Fig. 14—Distribution of Third-Echelon Job Orders after LONG THRUST Exercises
N 46
☐ Major-assembly replacements

Using the data from Table 21—which do not include second-echelon repairs made on the march—the percentage of vehicles deadlined for second- or third-echelon maintenance lies in the range 32 ± 5. This value was obtained by dividing the total of 216 from Table 21 by the total of vehicles known to have marched (608) and the maximum assumed to have marched (815).

An exact calculation of the percentage of vehicles requiring either second- or third-echelon maintenance on or after the march could not be made because the march report did not list the USA numbers of the vehicles and complete identification was not possible. Consequently it was not known whether vehicles repaired on the march also appeared on the deadline report. If all 52 vehicles presumed repaired on the march (i.e., experiencing deficiencies but able to complete the march) were not on the deadline reports and therefore not reflected

TABLE 20

AMG Vehicles Deadlined for Second Echelon during or after Road March, 15–25 Jul 63

Battalion maintenance detachment[a]	Trucks				APC	Tank
	¼-ton	¾-ton	2½-ton	5-ton		
1st	1	0	7	2	2	0
2d	11	1	5	2	8	9
Artillery	2	0	1	–	1	0
Support	10	0	37	4	–	–

[a]Excludes 3d Det, which did not submit report.

TABLE 21

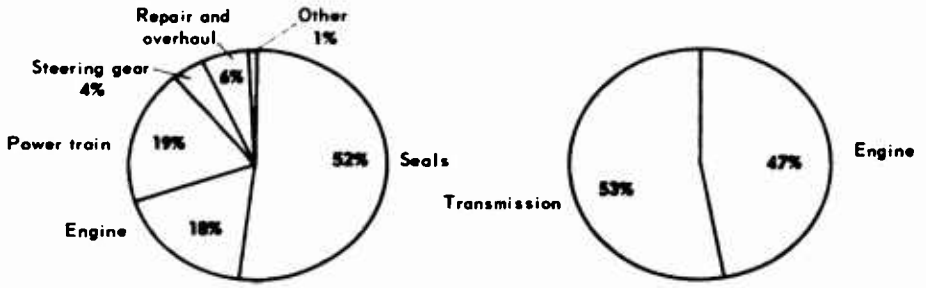
AMG Vehicles Deadlined for Second or Third Echelon during or after Road March, 15–25 Jul 63

Battalion maintenance detachment[a]	Trucks				APC	Tank	Total
	¼-ton	¾-ton	2½-ton	5-ton			
1st	2	–	20	6	8	–	
2d	9	1	6	3	17	13	
Artillery	17	1	2	–	1	–	
Support	11	21	65	13	–	–	
Total	39	23	93	22	26	13	216

[a]Excludes 3d Det, which did not submit report.

in Table 21, the percentage of vehicles requiring any form of maintenance on or after the march can be no larger than 38 ± 6. This value was obtained by adding the 52 vehicles to the 216 reported in Table 21 and dividing by the above-mentioned 608 and 815 vehicles.

Combining the two figures indicates that about one-third of the vehicles in the original configuration would require some form of maintenance during the first day when marched from their prepositioned site with no preparatory maintenance. (At this writing, after BIG LIFT preparation and use and the introduction of the new maintenance procedure, the vehicles are presumably in better condition.)



a. Wheeled Vehicles, *N* 127. b. Tracked Vehicles, *N* 21.

Fig. 15—Distribution of Third-Echelon Maintenance Required after 15–25 Jul 63 AMG Road March

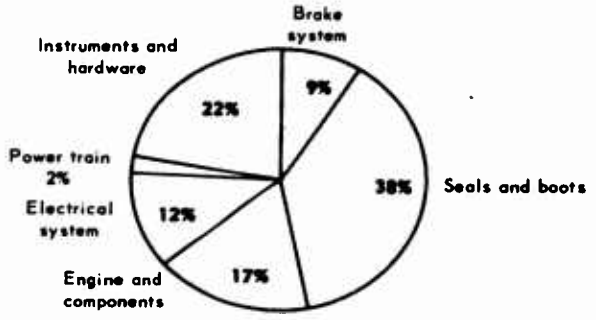


Fig. 16—Distribution of Deficiencies Deadlining Wheeled Vehicles for Second Echelon after 15–25 Jul 63 AMG Road March

Figure 15 shows the distribution of deficiencies for which vehicles were sent to third echelon after the road march.

Seals appear to be one of the main failures on wheeled vehicles and quite probably are the result of the vulnerability of the seal material to long-term storage.

The types of second-echelon deficiencies on wheeled vehicles noted during the march were essentially as shown in Fig. 13. A quite different pattern is shown by the deadline report, as Fig. 16 illustrates. Most of the deadlined vehicles were in need of parts, since the march created a demand in excess of stockage, especially for seals and boots. Apparently most of the brake difficulties were corrected on the march.

UTILIZATION WITH PREPARATORY MAINTENANCE

Data Sources

Exercise LT has been the only source of data on extended usage of prepositioned equipment.* Of the eight LT exercises of the equipment, only six completed the 6-month cycle described earlier. Data from five of these were obtained and form the basis for the following analysis, which is restricted to wheeled vehicles, as LT exercised a negligible number of tracked vehicles.

As has been mentioned, every vehicle issued to an LT unit had some amount of preparatory maintenance because the ample notice of the next usage of prepositioned equipment permitted the scheduling of extensive preparatory maintenance not provided for in the maintenance SOP. The results of issue without preparatory maintenance (see the previous section) strongly indicated the necessity of this preparation.

It was necessary to rely on entries in vehicle logbooks for most of the data. The accuracy of these entries is doubtful, but checks were available to place reasonable limits on accuracy. One LT unit was especially cooperative and a complete maintenance history was obtained, although the accuracy is questioned by the maintenance group itself.

Extent of Preparatory Maintenance

The preissue maintenance has consisted in the past of a Quarterly Inspection; a recent change in SOP makes this a Q2 or Semiannual (S) Inspection. The procedure followed in performing this inspection is prescribed for each type of vehicle. However, the time spent and the extent to which each item is checked is largely a matter of availability of time and personnel and of the condition of the vehicle. Following the prescribed order of inspection, the inspector notes deficiencies, which (theoretically) are corrected by the mechanic. A final inspection is made, and the duration of the Q (or S), in man-hours, is entered in the vehicle's logbook. From available data and expert opinion, the time expended on the Q varies between 4 man-hours and 50 man-hours for wheeled vehicles, with an average of 16 to 20 man-hours. Since the manpower required to maintain prepositioned vehicles is greatly influenced by the magnitude of this Q, a determination of the optimum time requirements is essential to the determination of the manpower requirements. However, this determination is not possible without operational data.

*A considerable amount of data was collected as a result of BIG LIFT, the analysis of which is published in a separate report.

Analysis of the logbooks showed that the recorded times for these Qs were closer to the low end of the estimated range because of several factors, not the least of which may be inaccurate entries in the logbook; there is reason to believe that in many cases the tabulation of man-hours was estimated rather than actually accounted for. In several instances the entries were made by a nonmechanic; for example, one unit preparing tanks for BIG LIFT spent 6 hr on every S for each tank, all being performed on the same day, indicating entries by persons other than the mechanics. In other instances elapsed time was recorded but not in terms of man-hours.

The preparation for LT VIII (17 Apr–6 Jun 63) was monitored closely in an effort to obtain realistic data on the extent of the preissue inspection. The logbooks of a sample of 121 vehicles were inspected and checked by a calculation of available man-hours per vehicle. The logbooks showed an average of 8.2 man-hours per (wheeled) vehicle, as shown in Table 22. In this case the mechanics were given specific instructions to record man-hours. Where more than one mechanic worked on a vehicle, the recorded man-hours were multiplied by the number of mechanics to guard against the possibility that, in spite of instructions, elapsed time had been recorded. Figure 17 shows the starting and completion dates for these Qs.

A calculation of total man-hours available was made in the following manner. Seven to nine mechanics worked during the 30 working days in the period sampled. The 121 vehicles included in the sample are those prepared by the maintenance company, which had primary responsibility for the vehicles. In late May it was realized that all of the vehicles could not be prepared by this company alone; the other two companies then began giving the vehicles the Q inspection. However, the sample included only those vehicles prepared by the seven to nine mechanics in one company. Assuming 8 on-bench hr/day and nine mechanics, a maximum of $30 \times 9 \times 8$, or 2160, man-hours was available in the period, and at least 121 vehicles were completely inspected. Some Qs were in process on 6 June, but, assuming none in process, a maximum of 2160/121, or 17.9, man-hours was available per Q inspection. However, a trailer was inspected with each vehicle, adding an average of 3 recorded man-hours. These 3 man-hours plus the recorded 8.2 man-hours give a total of 11.2 man-hours, as compared with the maximum possible available, 17.9.

The calculation shows that the recorded data may be off by a factor as large as 1.6. This value is useful in setting an upper limit on the amount of preparatory maintenance normally given an LT vehicle. Applying this ratio to the recorded value for man-hours—8.2—the range for man-hours per Q is 8 to 13 man-hours.

An effort was made to determine how this preissue maintenance varied with length of storage prior to issue. However, most of the records of the L&M detachments have been destroyed and complete case histories could not be compiled. Therefore no significant results were obtained.

Quarterly maintenance performed in the field by LT units was also examined to determine any effects of storage that might appear after issue and during subsequent operation. But again both maintenance personnel and procedures were different and nothing significant was found.

TABLE 22

IMG Wheeled Vehicles Sampled[a] for Q Inspections in Preparation for LONG THRUST VIII

Vehicle		Average recorded time per Q, man-hours
Type	Number	
¼-ton	63	8.2
¾-ton	41	7.6
2½-ton	10	9.4
5-ton	7	10.3
Total	121	8.2

[a]Sample from a total of 167 vehicles.

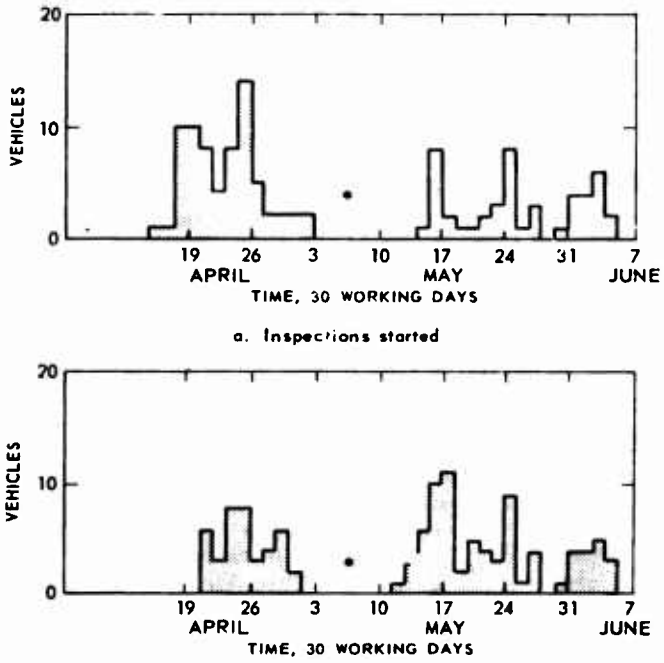


Fig. 17—Starting and Completion Dates of Q Inspections of Wheeled Vehicles, 1963

*Work suspended during command post exercise.

Only one set of vehicles went through a cycle of issue to an LT unit, return to active storage, and issue to another LT unit. Table 23 presents this data, obtained from vehicle logbooks. Again, and for virtually the same reasons, conclusions concerning the differencies between durations of Qs could not be drawn.

TABLE 23

Recorded Durations of Q Inspections on Prepositioned IMG Wheeled Vehicles

Type of Q[a]	Average recorded time expended, man-hours
Preparation for LT III	5.6
On LT III	7.3
After LT III	7.5
Preparation for LT VIII	8.2

[a]More than 100 Qs in each sample.

Findings of Preissue Inspections

Sixty-two of the preissue inspections for LT VIII were examined in detail. Data were collected from the Form 2404s prepared for the vehicles. Table 24 shows the type and frequency of the deficiencies found.

The most prevalent item, hardware and canvas, consisted of straps, covers, tiedowns, latches, hooks, etc.—none of which affect the combat serviceability of the vehicle. None of the engine items noted led to the replacement of an engine. Oil-level discrepancies, both high and low, accounted for many of the deficiencies in engines. (Leaky seals did lead to third-echelon replacements—mainly of the seals themselves.) Figure 18 shows a breakdown by major areas.

Fourteen vehicles in the entire battle group required parts the absence of which would have disabled the vehicle; ten of these were second-echelon or organizational-maintenance parts. All the third-echelon parts in the sample (62 veh) were seals. Figure 19 shows the distribution of all the third-echelon replacements for the entire battle group of 167 vehicles.

It seems, then, that the Q given to LT vehicles was about 8 to 13 man-hours in magnitude, and most of the deficiencies found as a result of the Q inspection were nondisabling. In case of a short warning time, the vehicles should be largely RFI with a maintenance program of proper dimension. Lacking this, the only alternative is concentration on detecting disabling items exclusively and repairing nondisabling items on a time-available basis only.

Reliability of Vehicles Issued after Preparatory Maintenance

Third-echelon repair records were chosen as the data source for calculating the reliability of vehicles issued after some preparatory maintenance.

TABLE 24

Maintenance and Repairs Required on 62 Preissue Q Inspections, IMG Wheeled Vehicles

Description[a]	Deficiencies	Parts replaced
Instruments and meters	15	12
Accessories	48	11
Engine	26	10
Steering	50	8
Clutch	4	0
Brakes	42	10
Generator, starter	17	6
Power train	41	8
Noises	0	0
Lamps	26	20
Temperature check	29	1
Leaks	63	13
Lubrication and tires	36	8
Battery	70	16
Battery voltage	1	0
Compression	0	0
Crankcase ventilation	68	3
Radiator	10	6
Pumps, belts, and pulleys	5	1
Valves	1	0
Ignition	10	4
Manifold	0	0
Carburetor	30	14
Exhaust system	9	2
Brakes and wheels	24	8
Hardware and canvas	682	475
Bumpers	37	1
Winch	16	3
Total	1360	640

[a]In same order as in all Army wheeled vehicle manuals.

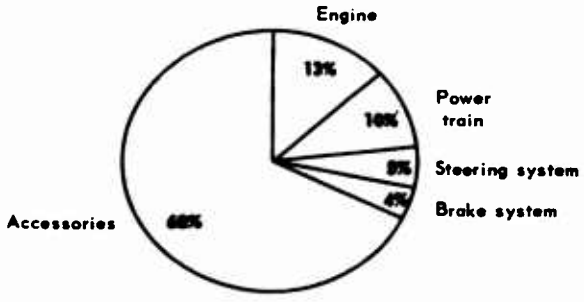


Fig. 18—Distribution of Second-Echelon Deficiencies Found on Preissue Q Inspections for LONG THRUST VIII
62 vehicles, 1360 deficiencies; only three major-item replacements noted.

The 90-day criterion discussed earlier involved major-assembly replacement as the basis for meeting the serviceability standards. Third-echelon information was readily available and is kept, by regulation, for at least 1 year. Both the vehicle logbooks and files of DA form 2407 provided third-echelon data on LT units. Both sources were checked for three different LT units, and no significant discrepancies were found.

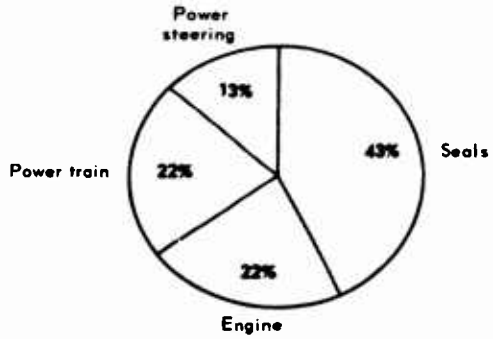


Fig. 19—Types of Third-Echelon Replacements on 167 Vehicles—Preissue Q Inspections—LONG THRUST VIII

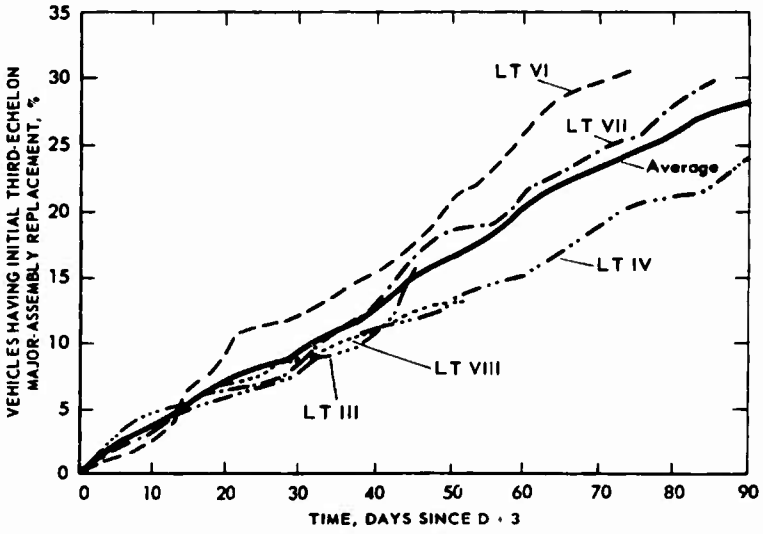


Fig. 20—Initial-Replacement Experience, Individual LONG THRUST Units and Average

The length of time before the initial third-echelon major-assembly replacement was used in the measurement of reliability. Figure 20 shows performance

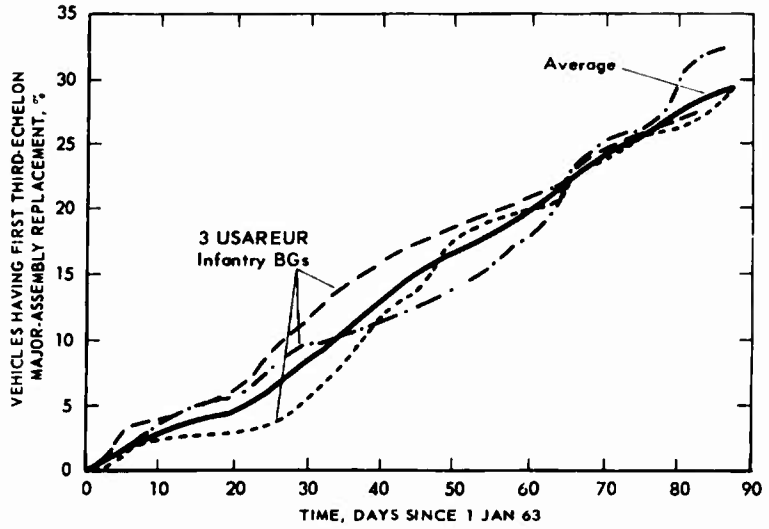


Fig. 21—Initial-Replacement Experience, Individual Active Units and Average

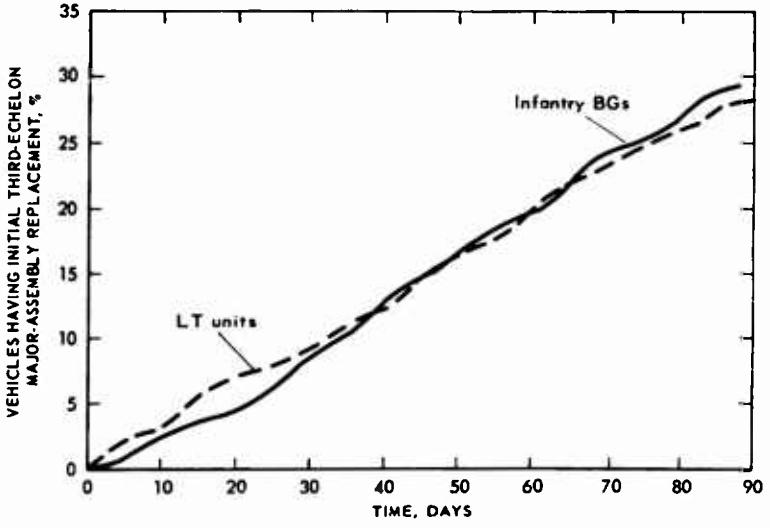
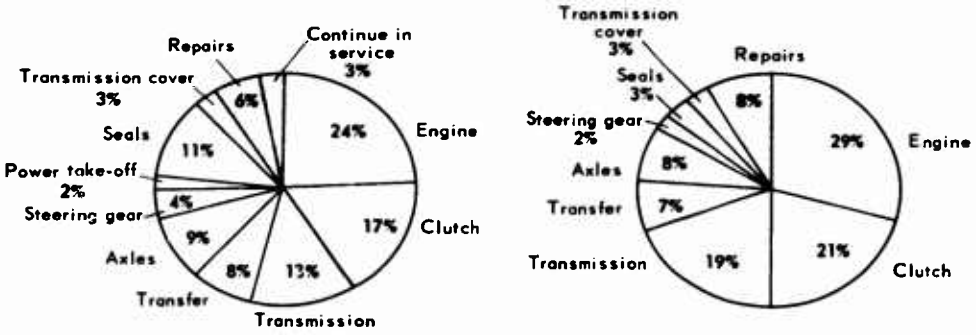


Fig. 22—Average Initial-Replacement Experience, LONG THRUST vs Active Units



a. LTs, N 428.

b. Typical BGs, N = 206.

Fig. 23—Distribution by Type of All Third-Echelon Job Orders, LONG THRUST Exercises and Typical Battle Groups

Replacements Other

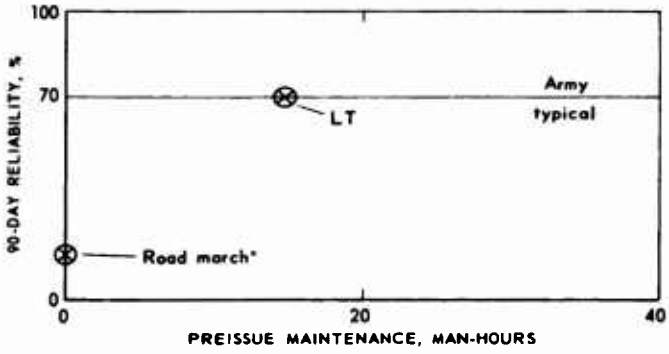


Fig. 24—Relation between 90-Day Reliability and Extent of Preissue Maintenance

*Extrapolated from 1-day, 100-mile march, assuming 500 miles/month as the conversion factor.

for the several LT units. The 90 days of operation of the LT vehicles was measured from a starting point set at 3 days after the first plane touched down (D+3), which corresponds to the time when marry-up is practically complete and the unit is beginning to operate its vehicles. No statistically significant difference was found between any of the LT units and the average for all, and for subsequent investigation all LT results were aggregated. The similarity of this replacement experience is to be expected because all LT samples are from a homogeneous vehicle population: all were placed in prepositioned storage at the same time and had the same mileage distribution. According to logbooks the vehicles had preparatory Qs of about the same magnitude (between 5.6 and 8.2 man-hours).

In attempting to establish a USAREUR standard, every effort was made to approach this same homogeneity. A period that included an FTX was selected for each unit. Operation during the 90 days was compared as closely as possible to the operation of the LT units. Figure 21 shows that the three battle groups examined differed very little with respect to replacement-part requirements. Inclusion of all the third-echelon repairs would have raised both curves about 6 or 8 percentage points, since approximately 35 percent of the vehicles required at least one trip to third echelon in 90 days. Figure 22 indicates approximate equivalence of the reliability of LT vehicles and those of active units.

Figure 23 shows distributions by type of all third-echelon job orders for LT and control units. The incidence of component replacement was slightly higher in active units, as was seal replacement on the LT vehicles.

The data are presented as evidence to indicate that, with respect to the replacement criterion, vehicles issued to a LT unit after comparatively low-level preparatory maintenance would probably perform as well as vehicles in active Seventh Army line units.

90-Day Reliability vs Extent of Preparatory Maintenance

The data from Fig. 21, as well as from the AMG road marches, were used to calculate first the mean life and then the 90-day reliability of the vehicles. The method of calculation is shown in App B. The values for 90-day reliability were then plotted against the extent of preparatory maintenance (see Fig. 24). The LT units averaged 500 miles/month, and the plotted values reflect this usage rate.

Figure 24 is an attempt to determine the extent of preparatory maintenance advisable. Unfortunately only two points are now available, but the results from BIG LIFT issue after extensive maintenance will yield the third point and make the determination possible.

Appendixes

Appendix A

EXTRACTS FROM MAINTENANCE-GROUP SOP[11,12]

LOGISTICS

1. PURPOSE

a. . . . provides guidance for procurement, marking, storage, maintenance, exercise, and issue of TOE equipment for a TOE 17D Armored Division and five attached non-divisional battalions organized under TOEs shown below:

(1) Two Combat Engineer Battalions under TOE 5-35D
(2) Two Artillery Battalions under TOE 6-425D
(3) One Artillery Battalion under TOE 6-415D

and for a TOE 7D Infantry Division and two attached non-divisional battalions organized under TOEs shown below:

(1) One Armor Battalion under TOE 17-25D
(2) One Truck Battalion (Light) consisting of:
    (a) Headquarters and Headquarters Detachment under TOE 55-16D
    (b) Three companies under TOE 55-17E

b. When appropriate, the instructions will be expanded to include turn-in of equipment from TOE units to the Maintenance Group, post-exercise maintenance, and restorage.

* * * * *

3. TYPES OF EQUIPMENT TO BE MAINTAINED

a. The prepositioned equipment includes the following types of major items:

(1) Carrier, personnel, M59
(2) Howitzer, self-propelled, M44 series (155-mm)
(3) Howitzer, self-propelled, M52 series (105-mm)
(4) Gun, self-propelled, M55 series (8-in. gun)
(5) Recovery vehicle, tank, M88 series
(6) Tank, medium, 90-mm gun, M48A1 series
(7) Truck, cargo, 2½-ton M34 and M35 series
(8) Truck, cargo, 5-ton, M54 series
(9) Truck, dump, 5-ton, M51 series
(10) Truck, utility ¼-ton, M38, M38A1, and M151 series

* * * * *

4. WEEKLY SCHEDULES. Weekly schedules will be prepared by each battalion to show time scheduled for maintenance and exercise of prepositioned equipment. Other activities such as training and physical conditioning will be included in these schedules.

1. SUPPLY OF PREPOSITIONED EQUIPMENT AND ASSOCIATED SUPPLIES

a. Stockage objectives. All TOE equipment and prescribed loads, with exception of medical, ordnance small arms, aircraft, ammunition, and crypto equipment, will be prepositioned and stored by the Maintenance Group. Excepted items will be prepositioned and stored in Seventh Army and COMMZ depots.

b. Procurement

(1) Initial Issue. Initial issue and delivery of prepositioned TOE equipment and associated supplies are effected by supply control agencies of COMMZ and Seventh Army. Unit requisitions are not required. Units will requisition components found short upon receipt of major items.

(2) Equipment prepositioned in depots

(a) Requisitions for small arms will be prepared, omitting the document number and signature block, and placed in a suspense file. Upon notification that weapons will be issued, suspense copies will be completed, entered in the document register, and processed. Small arms are prepositioned in the general depot adjacent to unit locations.

(b) Medical equipment and aircraft do not require requisitions. This equipment will be issued with documentation. (See Maintenance Group OPERATIONS PLAN and Seventh Army msg AETTR-S 133922, 1961.)

(c) Crypto equipment is stored by the Signal Maintenance Company and will be issued only to unit crypto custodians of an incoming division. Upon issue, Para 10, Seventh Army Circular 735-30 will apply.

(d) Ammunition. See Maintenance Group OPERATIONS PLAN.

(e) POL. Prepositioned as follows:

1. Quantity: 150 miles
2. Vehicle fuel tanks full
3. 5000-gallon tankers, 1200-gallon tankers, and 600-gallon pods kept full
4. Remainder stored by units in 5-gallon cans

(3) ASL and AOSL. Authorized stockage lists are furnished by Seventh Army. Stockage levels will not be changed. Use of prepositioned ASL and AOSL stocks for normal day-to-day maintenance is not authorized.

(4) Replacement issues. By unit requisition on supporting DSU.

2. SUPPLY OF TD EQUIPMENT, REPAIR PARTS, AND CONSUMABLE SUPPLIES

a. Allowances

(1) TD equipment and consumable supply allowances will be as indicated in appropriate DA Tables of Allowances, Seventh Army Circulars, TD 73-3783, and TD 73-3784, as applicable.

(2) Special Authorized Organization Stockage List (AOSL) will be established and approved by the appropriate technical service Direct Support Unit (DSU) prior to stocking.

(3) Prescribed load of Class I and Class V will be maintained on hand for TD personnel and accounted for in the Bn Installation Property Book (C-1).

b. Procurement. Units will requisition and retain only those items required to perform their mission. See letter, Headquarters Seventh Army, AETGD-PS, subject: Maintenance of Prepositioned Equipment, 22 Jan 62, for listing of DSUs.

c. Funding. Consumer credits for procurement of general engineer supplies, allied POL products, and Self-Service Supply Center are allocated by Seventh Army. Further distribution will be announced by letter from this headquarters. Credits for support of units stationed in France are allocated to COMMZ. The Commander of the Trains Maintenance Battalion will coordinate use of these credits.

* * * * *

PROPERTY ACCOUNTABILITY

1. ACCOUNTING FOR PREPOSITIONED EQUIPMENT AND ASSOCIATED SUPPLIES

a. Property Records. Property records will be maintained in accordance with AR 735-35, USAREUR Cir 735-35, and Seventh Army Cir 735-30.

b. ASL and AOSL will be entered and maintained in visible files in accordance with Seventh Army Supply Manual.

c. Stock Fund (Depot) Owned Property. The quantity of depot-owned property will be indicated by a pencil entry in the item description block on the appropriate property book page.

2. ACCOUNTING FOR TD EQUIPMENT, REPAIR PARTS, AND CONSUMABLE SUPPLIES

a. Property Records. Each Maintenance Battalion Commander will establish one installation property book for all units under his jurisdiction. He will hand receipt the property to users. TD property will consist of equipment normally issued on a per-individual basis, i.e., weapons, gas masks, etc.

b. Special AOSL. Upon approval of the DSU, special AOSLs will be entered and maintained in visible book files.

3. INVENTORIES. Inventories will be accomplished in accordance with AR 735-35. Property Book Officers (PBOs) will accept unopened containers, whether packed by depot, manufacturer, or unit personnel, if they meet the criteria established by para 6q, AR 735-11. Containers packed by unit personnel will have a packing list and a certificate affixed to the outside of the container indicating unit designation, contents, date of packing, and signature of PBO.

UTILIZATION OF PREPOSITIONED EQUIPMENT

1. VEHICLES. A limited number of prepositioned vehicles may be removed from storage and utilized for administrative purposes. Vehicles may be rotated from storage. Complete "Q" services will be made prior to placing vehicles back into storage.

2. TOOL SETS AND RELATED EQUIPMENT. This equipment may be used as required for the maintenance of prepositioned equipment. Only those items actually utilized for this purpose will be removed from depot pack. When equipment is no longer required, it will be cleaned, preserved, repacked, and returned to storage.

STORAGE AND MAINTENANCE

* * * * *

2. STORAGE

a. Except as modified in the TABs to this annex, all equipment will be stored in depot pack configuration. Five percent of depot packed equipment will be inspected each calendar quarter for evidence of in-storage deterioration. Whenever deterioration is detected, all like equipment will be opened, serviced as required, and returned to depot pack.

b. In-Storage Segregation. Equipment will be stacked by TOE company and battery. Where space permits, further segregation by platoon and section is desirable.

Organization of warehouses will facilitate outloading of equipment in accordance with unit loading plans. Diagrams of each storage warehouse, showing the location of equipment stored therein, will be prepared and maintained by subordinate units of the Maintenance Group. Depot packs containing quantities greater than the allowance for one company will be stored separately within warehouses. Sensitive items such as binoculars will be appropriately secured.

3. MARKING

a. Company, section, and platoon stacks will be identified with unit designations. Each box or crate will be legibly stenciled to show nomenclature and quantity of contents.

b. Bumper numbers of unit vehicles designated to transport containers will be stenciled on each container.

c. OEM boxes will be marked with vehicle type and unit bumper numbers.

d. Packing lists. Containers for sets, chests, kits, and OEM will have a packing list affixed to the outer surface listing all contents of the container. Packing list will be certified by unit property book officers.

e. Tool sets. Appropriate items of organization tool sets will be permanently installed on maintenance vehicles.

f. ASL and AOSLs. ASL and AOSL items will be recorded on visible files and stowed in parts trucks. Parts which exceed transport capability of unit parts and maintenance vehicles will be placed in warehouse storage. Outside storage is authorized for those larger repair parts which are packed in all-weather containers.

g. OEM machine guns. OEM machine guns will be placed in VCI pack and stored in the general depot adjacent to unit kasernes. Authority for this storage is Memorandum for Record, Headquarters, Fourth Logistical Command, 24 Nov 1961, signed: Chezarek.

4. MAINTENANCE. See letter, Headquarters, Seventh Army, AETGD-PS, subject: Maintenance of Prepositioned Equipment, 22 Jan 1962, and TM 38-750.

a. Standards. See Seventh Army Circulars 750-5 and 750-7.

b. Inspections. Maintenance surveillance inspections are conducted by Headquarters, Seventh Army Support Command. Schedule of inspections is announced periodically by letter from that headquarters. This headquarters will conduct such informal inspections as are found consistent with availability of time and personnel.

RECEIPT OF A DIVISION OR TASK FORCE

1. GENERAL

a. This annex provides standardized procedures for the receipt of a division or separate task force. It includes guidance for the reception of incoming troops, command of incoming troops, Maintenance Group activities prior to and after the arrival of a division or task force, and procedures for the issue and return to storage of prepositioned equipment.

b. The OPERATIONS PLAN of the Maintenance Group, which is classified and issued separately, contains detailed guidance pertaining to receipt of a division or task force deployed from CONUS.

2. DEPLOYMENT

a. Advance Party. The conditions under which a division or task force is ordered from CONUS to Europe will dictate the requirement for and composition of an advance party. If an advance party is required, a suggested composition is included in the Maintenance Group's OPERATIONS PLAN.

b. Task organization. A task organization and arrival sequence for the division or task force are included in the OPERATIONS PLAN. Organic division combat support and service units will be scheduled to arrive early so they will be available to support the remainder of the division upon arrival.

c. Non-organic support. Orders, directives, and plans of higher headquarters will indicate the extent of technical service support to be provided and the location of this support based on the size of the unit deployed.

3. COMMAND OF INCOMING TROOPS. The Commanding General, Seventh US Army Support Command, will exercise command of incoming troops until the division or separate task force is assigned to a Seventh US Army tactical headquarters. Seventh Army Support Command will exercise operational control through the Maintenance Group until issue of prepositioned equipment is complete and units have moved to predesignated dispersal areas.

4. MAINTENANCE GROUP ACTIVITIES PRIOR TO ARRIVAL OF TROOPS

a. The Maintenance Group will accomplish the following, within time available to them, prior to the arrival of incoming troops:

(1) Submit ration requests
(2) Orient Maintenance Group personnel
(3) Establish bivouac, to include mess, maintenance, and latrine areas
(4) Load vehicular OEM and TOE equipment
(5) Mount radio sets and antennas in wheeled vehicles
(6) Move vehicles and equipment to dispersal areas
(7) Pick up bulk POL
(8) Top-off vehicle fuel tanks and replenish POL basic load
(9) Position tank and artillery OEM beside vehicles in dispersal areas
(10) Pick up prepositioned weapons
(11) Pick up prepositioned ammunition
(12) Pick up prepositioned medical supplies from depot

b. Bivouac areas. The commander of each Maintenance Group subordinate battalion will previously have selected an appropriate dispersal area and made arrangements for its use. The commander of the Maintenance Group will insure that each officer and key non-commissioned officer has made a detailed reconnaissance of dispersal and bivouac areas selected, including routes thereto, so that operations can be executed at any time. Additional reconnaissance must be made to allow for changes in personnel within the Maintenance Group, adverse weather conditions, and seasonal changes.

c. Movement to bivouac areas. Upon being alerted that a division or separate task force has been ordered from CONUS, the Maintenance Group will prepare the preselected bivouac areas, to include erection of TOE tents, preparation of mess, maintenance, and latrine areas. Within the time available, the Maintenance Group will move vehicles and equipment to the preselected areas. In the event this cannot be accomplished in the time available, the Maintenance Group will request assistance from the incoming troops, or their advance party, if such a party is provided. In accordance with the Maintenance Group's subordinate units loading plans, equipment will be loaded on vehicle by personnel of the Maintenance Group. Movement to preselected areas will be controlled and will be at least by company-size units. Road clearances will be obtained and march orders issued by Headquarters, Maintenance Group.

5. RECEPTION OF TROOPS

a. Arrival Airfield Control Group (ACG). Upon notification of the arrival of a division or task force, an Arrival Airfield Control Group will be established. This group will coordinate the unloading of troops from aircraft and the rapid loading and dispatch of incoming troops by truck, bus, or train to their unit dispersal areas. The ACG will make special arrangements to expedite the dispatch of appropriate commanders and their key staff officers.

* * * * *

c. Reception. Incoming troops will be met by the senior officer present with the ACG. This officer will brief troops prior to deplaning. The briefing will be short and consist of a welcome and those items which are critical, such as safe driving practices, USAREUR curfew, conduct and relationships with German civilians, etc. Troops will be issued a box lunch and beverage. The incoming troops will then be loaded on buses or trucks. Their accompanied baggage will be placed on trucks by the baggage detail. The guides from the maintenance unit on whose equipment the troops will marry-up will then move the troops to their predesignated areas.

* * * * *

d. Transportation for incoming troops. Bus, truck, or rail transportation will be provided incoming troops by Transportation Corps units. The ACG coordinates placement, loading, and dispatch of transportation provided.

e. Movement to dispersal area. Incoming troops will be moved to the predesignated dispersal areas as follows:

(1) Troops whose equipment is prepositioned in Kaiserslautern will be transported direct to their dispersal areas.

(2) Troops whose equipment is prepositioned at Pirmasens and Germersheim will be moved to close-in dispersal areas.

* * * * *

(4) Incoming troops from the division engineer, ordnance, signal, and quartermaster battalions will be transported direct to close-in assembly area or to the kasernes in which their equipment is prepositioned for marry-up and to start normal support for the division or separate task force.

(5) Troops whose equipment is prepositioned in Mannheim will be transported directly to their assigned dispersal staging areas.

(6) Troops whose equipment is prepositioned in Karlsruhe will be moved to assigned dispersal staging areas.

f. Arrival at dispersal areas. Upon arrival at predesignated dispersal areas, or the kasernes indicated above, the officer in charge of each arriving company-size unit will be informed of the location of his mess area, maintenance area, latrine area, and TOE equipment. If all vehicles and equipment have not yet arrived at the dispersal area, he will be informed of the expected time of arrival of the remainder of his equipment. If personnel from the incoming company are required to assist the Maintenance Group in movement of vehicles and equipment to the dispersal area, the incoming company commander will be advised of this requirement. The incoming company commander will insure that action has been initiated to have his designated representative inventory and sign for all prepositioned equipment. Incoming troops will immediately establish their bivouac and begin deprocessing equipment.

6. MAINTENANCE GROUP ACTIVITIES AFTER ARRIVAL OF TROOPS

a. After arrival of troops, the Maintenance Group will accomplish the following to the extent possible, considering time and personnel available:

(1) Move remainder of vehicles and equipment to dispersal areas assisted as necessary by troops which have just arrived.

(2) Draw remainder of equipment from depots where it has been prepositioned, assisted as necessary by troops which have arrived.

(3) Issue equipment.

(4) Assist in deprocessing equipment and in stowing ammunition in tanks and artillery vehicles.

(5) Assist in combat loading of all vehicles.

(6) Estimate completion time of deprocessing and combat loading and request road clearance for march to dispersal areas.

(7) As each battalion or separate company completes loading and movement to dispersal area, the Maintenance Group S-3 will be informed.

(8) Assist the troops just arrived to the maximum extent possible.

(9) Provide guides to accompany units to dispersal areas.

(10) Keep Commanding General, Seventh Army Support Command, informed as to status of marry-up operations and time each major unit of the division closes in their dispersal area.

7. LOADING PLANS

To facilitate issue and loading of equipment, basic loading plans will be prepared by subordinate Maintenance Group units for each company-size unit of the division. These loading plans will be filed in a loose-leaf binder, and will be based on the loading of TOE vehicles with boxed equipment and supplies. The first page of the plan will consist of a list which shows each vehicle in the company, its unit bumper number, and assignment within the company. The second page of the plan will list those containers which require special handling, such as OEM for tanks and boxes of ammunition. Succeeding pages will consist of lists of vehicles and the containers which they transfer.

8. DEPARTURE OF TROOPS

a. General. In the event a task force, or other major portion of a division, is deployed from CONUS to Europe on a mobility exercise, the procedures outlined below will apply for redeployment.

b. Turn-in of equipment. See para 9, below.

c. Departure Airfield Control Group. A Departure Airfield Control Group (DACG) will be established at the departure airfield. This group will coordinate outloading of departing troops with MATS traffic control and commanders of troop units. The DACG will be organized similar to the Arrival Airfield Control Group. The commander of the troop unit will marshal troops, baggage, and TAT equipment into flight serials in bivouac areas per instructions from the DACG. Transportation units will move flight serials to the departure airfield to arrive four hours prior to the ETD for each airplane. The troop unit commander will appoint a serial commander for each flight. Loading of baggage and TAT equipment will be accomplished by personnel of the DACG. Troops will board aircraft upon call from MATS traffic control under supervision of the DACG. The DACG will maintain a status chart on all flights and will inform this headquarters of any deviations from schedules greater than fifteen minutes.

* * * * *

9. PROCEDURES FOR INVENTORY, ISSUE, TURN-IN, and RESTORAGE OF EQUIPMENT

a. General. The procedures outlined below provide guidance to the Maintenance Group for issue, inventory, turn-in, and restorage of supplies and equipment to an incoming division or separate task force. Information pertaining to the location of technical service depots, schedules for pick up of ammunition, prepositioned weapons, and medical supplies is contained in the classified OPERATIONS PLAN for the Maintenance Group. Procedures for maintenance, exercise, and storage of equipment are included in Annex B (Logistics) to this SOP. Plans and SOPs developed by subordinate units of the Maintenance Group must provide for accurate and timely inventory of equipment by property book officers, fast issue of equipment, effective re-boxing, turn-in, and restorage procedures. Sufficient time must be provided in plans and orders for the using division or task force to properly clean and reprocess all equipment for storage prior to their departure to CONUS.

b. Inventory and issue of equipment and supplies. Inventories conducted by incoming property book officers will be accomplished as expeditiously as possible. The maintenance Group will maintain complete suspense hand receipt files to facilitate issue of TOE property. These hand receipts will be prepared in duplicate and will provide for issue of equipment at company level for battalions, and at section and platoon level for separate companies. The duplicate copies of hand receipts will be furnished to the incoming unit commander or his authorized representative, who will inventory the property. Upon completion of the inventory, both copies of the hand receipts will be signed. The incoming unit commander will retain the duplicate copy, and the Maintenance Group property book officer will retain the other, until the incoming property book officer accomplishes the prescribed certificate on page 1 of the property book and enters his unit designation on each page of the book (see AR 735-35).

(1) Deprocessing of equipment. All equipment will be deprocessed by incoming troops. The Maintenance Group will provide necessary cleaning and preserving

supplies such as solvent, wire brushes, preservative oil, and rags to incoming troops. Care must be used in opening boxes and crates as these containers will be utilized for repacking equipment and returning it to prepositioned storage. The Maintenance Group will retain custody of containers and other supplies required for placing equipment back in storage if the incoming troops are involved in an exercise-type operation.

(2) Loading equipment. Equipment will be loaded on vehicles as specified in the Maintenance Group loading plans and the Group's OPERATIONS PLAN.

(3) Class I Supplies

(a) Prescribed loads are maintained on hand by the Maintenance Group in accordance with Seventh US Army directives. Upon arrival, incoming troops will be issued their authorized load of "C" rations by the Maintenance Group. These prepositioned rations will be opened and consumed only under those conditions specified in (b) below. Ration requests will be submitted to the local Class I ECP bo Maintenance Group Property Book officers as follows:

1. Strength: TOE strength of incoming units.
2. When submitted: Seven days prior to arrival of main body.
3. Period covered: First ten days, inclusive, after arrival of main body.

(b) In the event a division or portion thereof is deployed under emergency conditions which preclude compliance with the above, ration requests will be submitted immediately upon receipt of the warning order. Under these conditions, consumption of the prepositioned prescribed load is authorized.

(4) Class II and IV Supplies. Prescribed loads of ASL and AOSL items are maintained by the Maintenance Group. Small ordnance items are prepositioned in spare parts cabinets mounted on unit maintenance trucks or in the ordnance battalions' spare parts vans. Prepositioned stocks of these items are not used for current maintenance by the Maintenance Group. Incoming units will draw required replacement ASL and AOSL items from the appropriate DSU when required. The administrative portion of appropriate orders and plans indicate the location of supporting DSUs. Initially, incoming units will use items from prepositioned ASL and AOSL stocks. The incoming units organic DSU will utilize the nearest transceiver station to transmit requirements to Seventh Army Stock Control Center.

(5) Class III Supplies. The entire prescribed load (150 miles) of Class III supplies will be prepositioned by the Maintenance Group. Gasoline will be stored in accordance with Seventh Army Circular 700-7.

(a) Initial supply. Initially, the incoming unit will use the prescribed load of Class III.

(b) Resupply. Resupply of Class III will be effected according to the incoming units SOP and the administrative portion of higher headquarters orders and plans.

(6) Class V Supplies.* Class V items are prepositioned in depots as indicated in the Maintenance Group OPERATIONS PLAN. Detailed schedules for pick up of ammunition, by units, are also included in this plan. The Maintenance Group will maintain suspense documentation to effect rapid issue. This documentation will provide for the timely separate drawing of authorized basic loads for battalions and separate companies in two parts as follows:

(a) Ammunition carried in armored vehicles.

(b) Ammunition to be carried in unit trains. If the incoming troops are to participate in an exercise-type operation, their unit trains will be loaded last. This will permit use of ammunition trucks for the transportation of troops and equipment such as OEM for tanks and artillery.

(7) Weapons. Weapons for incoming troops are prepositioned in depots as shown in the Maintenance Group OPERATIONS PLAN. These depots maintain identity by sub-unit "mark-for" numbers. The Maintenance Group will maintain requisitions,

**"Present authorization is for 5 days of supply to support the prepositioned division at SB 38-26 rates. This quantity is not sufficient to support all the basic load requirements for the prepositioned divisions." (Seventh Army Ordnance Officer comment, May 1964.)

DA Form 1546, in a suspense file for these items and, time permitting, will pick up the weapons from the depot and issue them to incoming unit property book officers.

(8) Medical supplies. These supplies are maintained in a depot as indicated in the Maintenance Group OPERATIONS PLAN. Unit identity is provided for by sub-unit "mark-for" numbers. Equipment for a division, or any portion thereof, will be issued to the Maintenance Group when requested for further issue to the incoming unit. Medical equipment is maintained and rotated as required by the depot.

(9) Army aircraft. Aircraft authorized the division under TOE 17D or TOE 7D are not prepositioned or maintained by the Maintenance Group. These aircraft are retained under Seventh US Army control for issue to the incoming division or task force on call. (Reference: Seventh US Army Message AETTROS 133902, 1961.)

(10) Crypto equipment. This equipment is stored, maintained, and accounted for as shown in the Maintenance Group OPERATIONS PLAN. Procedures for issue of crypto equipment to incoming troops are also included in this plan.

* * * * *

c. Turn-in and restorage of supplies and equipment. In the event that the incoming division or separate task force is involved in an exercise-type operation which requires return of equipment to prepositioned storage, the following procedures apply:

(1) Joint inventory of all supplies and equipment will be conducted by the outgoing property book officers and the Maintenance Group property book officers.

(2) Equipment and supplies unaccounted for will be placed on report of survey by the using unit property book officer. This officer will prepare necessary requisitions for all shortages, to include prescribed and basic loads.

(3) Specific responsibilities of outgoing unit and Maintenance Group personnel are as follows:

(a) Outgoing units:

1. Thoroughly clean, preserve, and otherwise reprocess all equipment for storage, under guidance of Maintenance Group.

2. Perform "Q" maintenance service on vehicles.

3. Perform monthly service on signal, chemical, engineer, and quartermaster equipment.

4. Perform PE on Army aircraft.

5. VCI pack tank and artillery cannons, crew-served weapons, and all small arms.

6. Repack ammunition and return to appropriate depot.

7. Repack and restore all equipment with assistance of Maintenance Group.

(b) Maintenance Group:

1. Request surveillance inspection from Seventh Army.

2. Provide required cleaning, preserving, and packing supplies and material to outgoing units.

3. Advise and assist outgoing units to maximum extent possible to preclude unnecessarily delaying their departure.

4. Insure that all equipment has been properly processed for storage. Assistance in inspection of equipment for storage should be requested from appropriate technical service units.

5. Accept unit property books upon completion of joint inventories and relief from responsibility action.

6. Take necessary follow-up action on requisitions submitted for shortages.

7. Turn in excess supplies and equipment.

Appendix B

COMPUTATION OF 90-DAY RELIABILITY

According to the exponential failure law, items fail at a rate proportional to the number of survivors. As a result the fraction $F(t)$ surviving at a time t is given by

$$F(t) = e^{-t/\theta} \qquad \text{(B1)}$$

where $e = 2.7183\ldots$, and θ is the mean life of the item. This law covers a wide variety of items subject to failure.

If items fail according to this law, and if only the first n failures are observed, then the mean life θ is given approximately[36] by the expression

$$\theta = \frac{1}{n}\{t_1 + t_2 + \ldots + t_n + (N-n)t_n\} \qquad \text{(B2)}$$

where t_i is the time at which the ith failure occurred, and N is the total number of items at time zero.

Based on data acquired from the LT exercises and the infantry battle groups, Eq B2 has been used to estimate vehicle mean life, interpreting "failure" to mean requirement for the first third-echelon major-assembly replacement. The results are given in Table B1.

TABLE B1

Mean Lives of Vehicles in LONG THRUST Exercise and Infantry Battle Groups

Data source	Vehicles				
	¼-ton	¾-ton	2½-ton	5-ton	Weighted average
	Time to initial failure,[a] days				
LT	261	370	266	340	285
Infantry BGs	266	361	192	399	273

[a]First time third-echelon major-assembly replacement is required.

The mileage and mission for both sets of units were similar during the observed time period. Therefore the values can be compared directly. Table B2 shows the mileage traveled by the LT vehicles under study. No differences

TABLE B2

Mileage Driven by Units in a LONG THRUST Exercise

Vehicle	Distance traveled in 90 days, miles
¼-ton	1600–1700
¾-ton	1200–1300
2½-ton	1100–1200
5-ton	500–600

TABLE B3

Percentage of Vehicles Requiring No Major-Assembly Replacement in 90 Days' Operation

Unit	Vehicles				
	¼-ton	¾-ton	2½-ton	5-ton	Weighted average
	Reliability, %				
LT	71	78	71	77	73
Infantry BGs	71	78	63	80	72

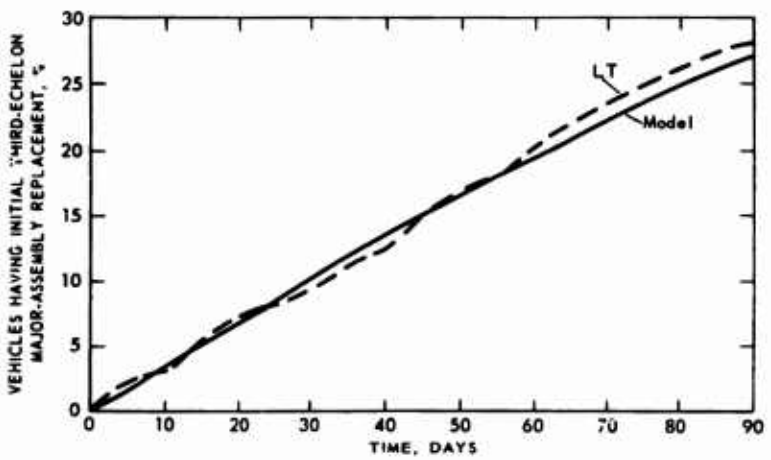


Fig. B1—Comparison of Model with LONG THRUST Data

between these and any of the values for like vehicles in Table B1 are statistically significant.

As explained in the body of this report, vehicle reliability in this study is measured principally in terms of the percentage of vehicles requiring no third-echelon major-assembly replacement for 90 days. This percentage is called the "90-day reliability." Given the vehicle mean life θ, the 90-day reliability F (90), can be calculated from Eq B1:

$$F(90) \quad e^{-(90/\theta)} \qquad \text{(B3)}$$

The values for 90-day reliability of the prepositioned (LT) and control (infantry battle groups) vehicles are shown in Table B3.

Figure B1 is presented as evidence of the close fit obtained by using Eq B1 to approximate the actual date.

Appendix C

DERIVATION OF MOS PRODUCTIVE TIME

In order to compare productivity of the maintenance groups with work-performance standards, a utilization of personnel index (UPI) was devised to permit numerical comparison. The index is defined as the ratio of the estimated workload per year* in man-hours to the estimated man-hour availability. A similar operation on existing work measurement standards gave the control limits. The index base in 1.00; i.e., workload equals availability of man-hours.

Man-hour availability was computed in several ways. SR 310-30-15, C2[27] uses a 12-hr day, 30 days/month, as the wartime work unit. Of the 360 hr/war month, only 47 percent, or 168 hr, is MOS productive availability. In peacetime the prescribed work period is 9 hr/day, 24 days/month, or a total of 216 hr. Application of the above percentage to the 216 hr gives an estimate of MOS productive time of 102 hr/month.

By actual observation, duty time per week is 5 days at 9 hr and ½ day at 4 hr, or a total of 49 hr. Nonproductive time per week is 5 hr for meals, 4 for inspection and police, 4 for training, 5 average for leave, 2 for other military duty and sick call, and 5 for administrative time, drawing tools and parts, and record keeping, for a total of 25 hr. Deducting this total from the 49 hr of duty time gives 24 hr/week available MOS productive time. Using an average of 4⅓ weeks/month, the estimate becomes 104 hr/month. Spot-check observations during Q inspections indicated the productive time might be as low as 95 hr/month because of standbys, record keeping, make-ready, etc.

The 47th Ord Gp computed productive time as slightly less than 25 hr/week, or a monthly total of 106 man-hours. For the purpose of analysis the figure of 105 man-hours/month or 1260 man-hours/year has been used as the measure of MOS availability.

*Taken on a yearly basis because of the fluctuations in the workload during the year.

Appendix D

EXTRACTS FROM TECHNICAL BULLETINS

EXTRACT FROM TB 9-299/1[13]

* * * * *

3. LEVELS OF PROTECTION

Processing described in this bulletin consists of three levels of protection including combat loading as prescribed in a through d below.

a. Level A. Maximum processing for domestic or overseas shipment, including storage in excess of 90 days from date of processing (periodic care and preservation during storage required).

b. Level B. Preservation and packaging requirements specified for this level are intended to provide adequate protection for domestic or overseas shipment (deck loading excluded) and which may involve storage outside of buildings for a combined total of approximately 90 days. When conditions of shipment or storage other than those described above are encountered, the level B requirements herein may be modified by responsible technical activities to the extent necessary to provide adequate protection.

c. Level C. Minimum processing for immediate domestic use shipments, from supply source to the first receiving activity. This level may conform to supplier's commercial practice when such practice meets the requirements of this level.

4. STORAGE CLASSIFICATIONS

Storage as used herein refers to the placing of vehicles in a warehouse, building, covered structure, or in an open area; and is classified as prescribed in a through j below.

a. Class A, Dormant Storage. Dormant storage includes all processed vehicles in storage which have been provided with protection against the entry of snow and rain by means of sealing, covering, or placing in shelters or buildings (dehumidified and non-dehumidified). Vehicles in dormant storage are not operated or exercised between specified reprocessing cycles.

b. Class A1, Outside of Buildings. Vehicles in Class A1 are protected by taping, spraying with strippable compounds, and affixing of engine compartment closures, when specified, in accordance with applicable vehicle processing instructions. (To be inspected each 30 days or after abnormal weather)

c. Class A2, Sheltered. Vehicles in Class A2 are protected by buildings (non-dehumidified), shelters, vehicle-affixed devices, or closures of structural characteristics, designed to afford protection from the elements. (To be inspected within 180 days)

d. Class A3, Dehumidified, Structural. Vehicles in Class A3 are protected by structures in which the atmosphere is maintained at a relative humidity of 40 percent or less by means of mechanical dehumidifying devices. Dehumidified (DH) record check is required. (To be inspected with 360 days)

e. Class A4, Dehumidified, Nonstructural. Vehicles in Class A4 are protected by complete or partial sealing of the vehicle and by means of mechanical or static dehumidification of each vehicle, singly or in a series, maintaining a controlled atmosphere within vehicle interior areas not exceeding 40 percent relative humidity. (Inspect in 30 days)

f. Class B, Activ. Storage. Active storage includes all vehicles which have been provided with basic protection as defined in a above, and for which certain processing

requirements are replaced or supplemented by specific periodic exercising by means of operating vehicle power plant or by remote source power. (Inspect as in corresponding classes of Class A)

g. Class B1, Outside of Buildings. Vehicles in Class B1 are protected as specified in b above, except what specified vehicle components are exercised by means of operating vehicle power plant or by remote source power as required.

h. Class B2, Sheltered. Vehicles in Class B2 are protected as specified in c above, except that specified vehicle components are exercised by means of operating vehicle power plant or by remote source power as required.

i. Class B3, Dehumidified, Structural. Vehicles in Class B3 are protected as specified in d above, except that specified vehicle components are exercised by means of operating vehicle power plant or by remote source power as required.

j. Class B4. Dehumidified, Nonstructural. Vehicles in Class B4 are protected as specified in e above, except that specified vehicle components are exercised by means of operating vehicle power plant or by remote source power as required.

EXTRACT FROM TB 9-300-1/1[14]*,†

* * * * *

2b. Condition-reservation Code 1 Serviceable—suitable for immediate unlimited use.

Condition-reservation Code 2 Serviceable—suitable for immediate limited use.

Condition-reservation Code 3 Serviceable—suitable for use after minor processing or repair and/or addition of missing attachments or components.

* * * * *

6. Frequency of Exercising

Critical or highly finished interior surfaces of vehicles and their components are subject to deterioration when mechanisms are not in use. To insure that vehicle components in storage remain in a serviceable condition, it is necessary that exercising be accomplished after inspections are completed and immediately prior to vehicle reprocessing. Exercising is performed for the purpose of distributing preservatives or lubricants over critical surfaces that normally would be accomplished by vehicle operation.

Exercising Intervals

	A1	A2	A3	A4	B1	B2	B3	B4
Method I (Unit Exercising)	180 dys	180 dys	AsReq	AsReq	N/A	15 dys	360 dys	N/A
Method II (External Power Exercise)	NA	NA	NA	NA	7 dys	7 dys	7 dys	7 dys

*This document and TB 9-300-2/1 contain the same definitions as TB 9-299/1.

†TB 9-300-2/1, "Wheeled Vehicles," gives substantially the same information except B1, 360 days with Method II; B2, 180 days with Method I, and 360 days with Method II; B3 and B4 as inspection indicates.

Appendix E

EXTRACT FROM V CORPS COMMENTS

The Commanding General, V Corps, in comments dated 25 Mar 64, stated the following:

* * * * *

The proposed study of the type and quantity of materiel to be prepositioned for the division slices is considered essential to the successful application of the concept of prepositioning. However, it is not believed to be in the best interests of the Seventh Army mission to delay necessary improvements in the present concept application until the study is concluded. This headquarters believes that the following three suggestions are of such value as to merit the immediate modification of the prepositioned stocks and parts system. The study to be undertaken can then evaluate these changes as existent in the applied concept:

(1) Prepositioned repair parts should be for those major items of equipment that are not compatible with equipment currently in use within units of Seventh Army. Repair parts for major items of equipment such as the M60 tank and the M113 personnel carrier should be stocked at Seventh Army depots in quantities to allow for quick issue to prepositioned custodial units. This system is currently in effect in CONUS to support STRAC and is a proven concept. This allows for continuous turn over of repair parts and does away with normal deterioration.

(2) The XM28 (light system) Davy Crockett should be replaced by the XM29 (heavy duty) Davy Crockett in order to provide a system that can be supported with test and handling equipment, trainers and the ancillary equipment that is available and compatible with the supply system. Also, test and handling gear and trainers for nuclear delivery and emplacement units should be prepositioned.

(3) Technical publications must be maintained in a current status to include posting of all changes. The Maintenance Group should establish a library that encompasses all publications that are pertinent to the equipment supported and in sufficient copies to provide technical libraries to units upon arrival. This procedure is preferable to providing the CONUS based units with the publications and changes and carrying them as TAT.

Appendix F

EXTRACT FROM SEVENTH ARMY COMMENTS

HEADQUARTERS, SEVENTH ARMY
APO 46, US FORCES

The Deputy Adjutant General, in comments dated 15 August 1964, stated:

2. (U) This paper is considered to be a valuable reference document for planning future prepositioning operations, and Seventh Army concurs generally with the findings as applicable to the period under study. As noted in the study, however, the status of prepositioning in Seventh Army has changed in many respects since the inception of Operation BIG LIFT, and action has already been taken on some of the conclusions. The remainder are under current study.

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